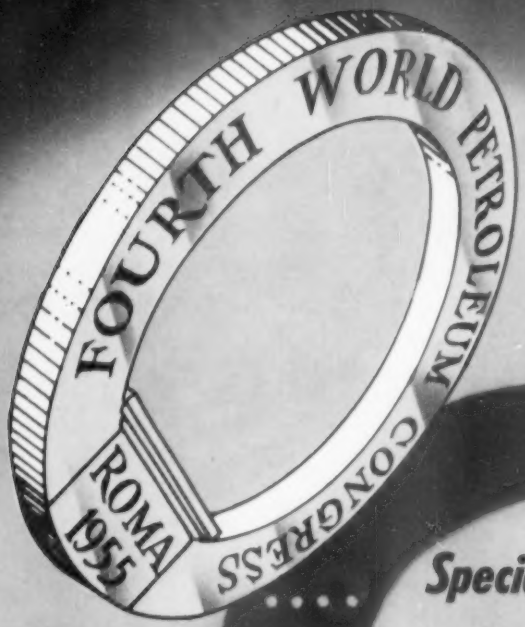
the OIL AND GAS JOURNAL

JUNE 6, 1955



Special report . . .

Highlights of the important technical papers presented at the nine divisions of the Fourth World Petroleum Congress

Plus—

A roundup of the Italian oil and gas industry . . .

Where Refiners Are Headed in Hydrogen Treating · P. 72

10 TIMKEN® bearings lick heavy loads and dirt—100 miles from nowhere

THE "CFD-1" Holemaster drills shot holes 1000 feet deep and drills them fast. To assure dependability out in the middle of nowhere, George E. Failing Company, the manufacturer, uses a total of 10 Timken® bearings—in drawworks gear box, rotary table and water swivel. Timken bearings also are used in the mud pump.

The rotary table must sometimes take the full weight of the drill string. This produces a heavy thrust load. So the table is mounted on Timken *tapered* roller bearings which take both radial AND thrust loads in any combination. No extra thrust bearings are required.

Timken bearings help solve another drilling headache—mud and water. Because of their extreme precision, the Timken bearings keep all parts concentric with their related components. This makes for more effective closures. Lubricant stays in, and dirt, dust and moisture stay out.

The Holemaster is completely mobile—compact and efficient. Timken bearings help—they permit compact assemblies because they have high load-carrying capacity for their size. One reason: full line contact between rollers and races.

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This symbol on a product means its bearings are the best.

GEORGE E. FAILING COMPANY uses ten Timken bearings in these key assemblies in the "CFD-1" Holemaster: drawworks gear box, rotary table, water swivel.

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PROFILOGRAPH TRACE, GOOD COMMERCIALLY GROUND FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)
PROFILOGRAPH TRACE, TIMKEN BEARING FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)
OPTICAL FLAT, PERFECT FINISH

SMOOTH TO MILLIONTHS OF AN INCH

Surface finish of high quality Timken bearing rollers and races is so smooth that it takes a profilograph to measure its smoothness. This instrument measures surface variations to a millionth of an inch, as shown at the left.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬮ AND THRUST →⬮← LOADS OR ANY COMBINATION →✳←

PAGE 1 ONE . . . *a glance ahead*

Refinery prices of premium gasoline are expected to stiffen as reflection of rising differential in cost over lower-octane fuel. Some refiners realize futility of meeting price-cutters' levels with high-cost product; will try to make premium fuel price stand on its own feet in relation to its cost.

Eastern Canada, including Maritime provinces, will be scene of more intensive oil search during next couple of years. Prospects there are fair, but potentially is nowhere as great as western Canada.

Market for paraffin and micro-crystalline wax is booming, may be up 15 per cent this year, chiefly because of demand for modern food packaging. Recent technological improvements in wax manufacture have revolutionized its characteristics and therefore its usefulness.

FPC approval of import of Canadian gas to Montana may be precedent for approval of imports into Washington and Minnesota later this summer. Lack of control over producers once considered by some a serious obstacle to imports—will be no problem if FPC applies the principle of the pending Harris bill relating to domestic producers.

Litigation over legality of FPC regulations on gas producers has been brought to virtual standstill both by courts and litigants while Congress deliberates amendments to Natural Gas Act. If bill fails to pass and Order 174-B remains in effect, rash of injunction suits will be pressed hard.

Replacement of obsolescent pump stations with fully automated equipment on old lines is being slowed by some pipeline companies by problem of reassigning workers whose jobs are no longer needed. In areas where company transfers are not practical, some lines may face difficult employe problems.

the OIL AND GAS JOURNAL

JUNE 6, 1955 • VOLUME 54 • NUMBER 5

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FOURTH WORLD PETROLEUM CONGRESS SECTION

4,000 Oil Men Gathered in Rome 93

By Kenneth B. Barnes and Wilbur L. Nelson

This is an eight-page article featuring some of the highlights of important papers to be presented during the Fourth World Petroleum Congress, June 6-15. Approximately 4,000 people are expected to attend the meeting. A total of 35 countries will be represented.

Italy's Natural Gas Expands Rapidly 102

By Lorenzo Goffredo

Production of natural gas in Italy has grown from 1,500 M.M.c.f. in 1945 to an estimated 120,000 M.M.c.f. in 1955, and is expected to reach 140,000 M.M.c.f. in 1956.

A Look at Italy's Production and Refining 106

By Alberto Girelli

Production activity in Italy centers in two areas, the Po River Valley and Sicily. Italy's refineries are now processing about 400,000 bbl. of crude per day.

Recent Strikes Stir Italy's Oil Finding Hopes 109

By Maurice Moyal

Prolific strikes at Ragusa, Sicily, and Alanno (Adriatic Seaboard) recently have accelerated Italy's oil-finding activities. These areas along with the Po Valley are Italy's most promising.

25 Years of Italian Progress 110

By Dr. Francesco Zurlini

In 1954, Italian oil consumption was over 8,300,000 tons, 94 per cent of which was processed by Italian refiners.

TECHNOLOGY—OPERATION

Modern Combination Processing at Canadian Petrofina Refinery 112

By George Weber

This Montreal, Que., Canadian plant incorporates five catalytic processes to process 20,000 bbl. per day of crude oil.

Unused and Unusuable Pipeline Rebuilt 115

By Paul Reed

Here's the story of a pipeline that wouldn't work until it was relaid according to established good practices.

Some Current Practices for Reducing Refinery Corrosion 120

By Gerald L. Farrar

Injection of air into refinery process unit will halt hydrogen penetration of steel. Use of organic corrosion inhibitor will cut corrosion and improve operations.

How to Size Up Wildcat Pay Zones 126

By J. E. Walstrom and J. C. Wells

With the tools now available and proper training in their use, complete formation evaluation can be achieved. More economical tools and a better integration of services are needed.

Lease Crude Can Be Used As Cheap Fracturing Fluid 133

By John J. Reynolds, Philip E. Bocquet, and Harry F. Coffer

Researchers at Continental Oil Co. have developed a chemical additive which will control the fluid loss of crude oil. This makes possible the use of lease crudes as effective fracturing fluids.

Pipeline Patrol: Multiplexed Telemetering for Gas Pipelines 151

By A. P. Hyde

In the fall of 1954, Piedmont Natural Gas Co. installed an expensive telemetering system. This has resulted in more efficient.

REGULAR FEATURES

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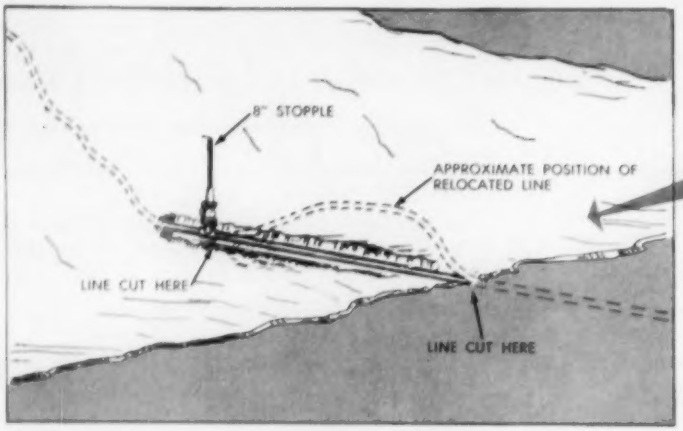
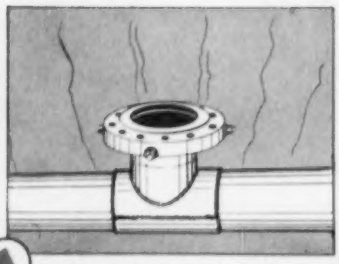


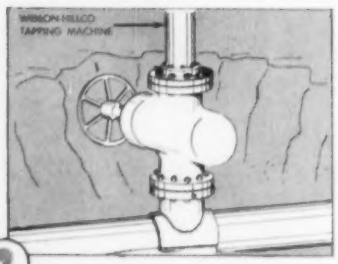
TO facilitate construction of a bridge to span the Lackawanna river, near Scranton, Penna. a major pipeline company relocated a section of their existing 8" products pipeline, using WmSON STOPPLES . . .

PRODUCTS PIPE LINE RELOCATED WHILE WmSON STOPPLE* HOLDS 735 PSI. PRESSURE

PROCEDURE



1 TWO 8" flanged split tees were welded to the pipeline on either side of the river.



2 AN 8" tapping valve was then installed on each fitting and taps made at approximately 750 PSI.

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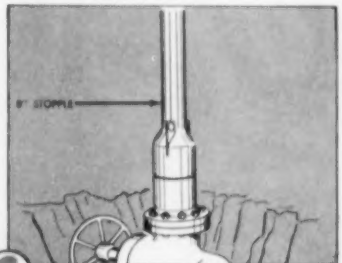
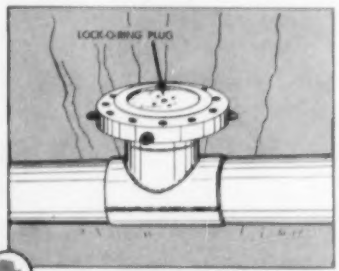


3 8" STOPPLES were then installed on tapping valves, and the line completely isolated by running the sealing element into position, the upstream STOPPLE holding pressure of about 735 PSI.



4 AFTER line was cut, drained and relocation made, STOPPLES were removed and lock-o-ring plugs installed to permit removal of tapping valves. Blind flanges were then installed.

WRITE FOR LITERATURE

*Pat. Pending

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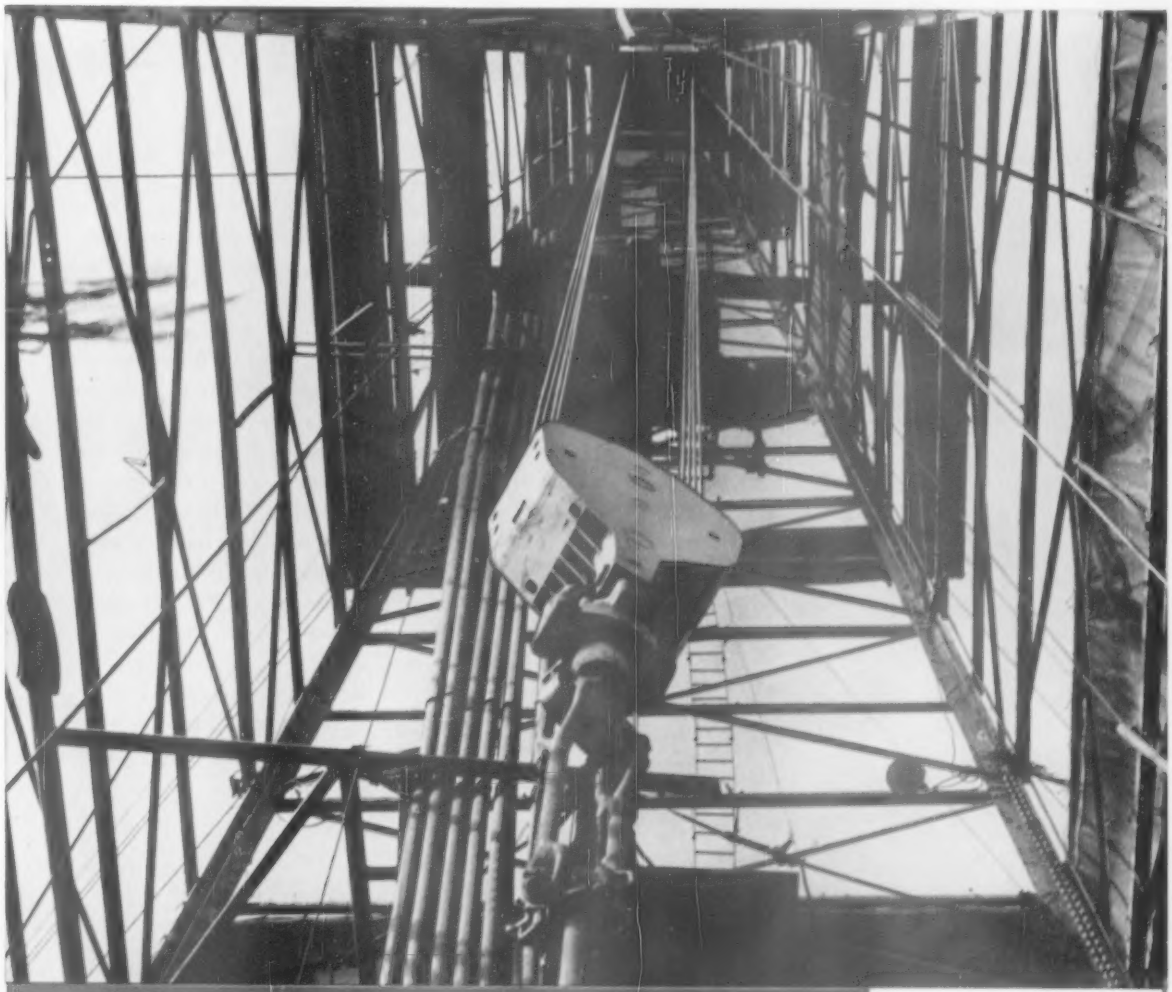

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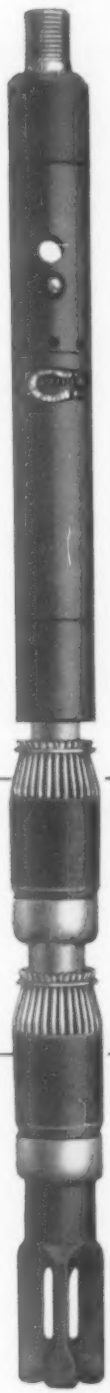

HEAVY DUTY TYPE SR RELIEF VALVE ON GUIBERSON TUBING SWAB

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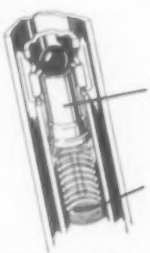

OVERLOAD RELIEF VALVE is easily adjusted in the field to support more or less fluid by changing number or thickness of shims under spring.

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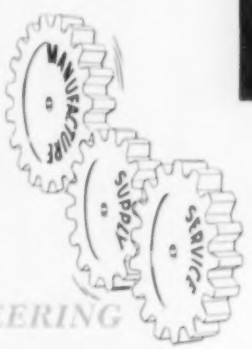

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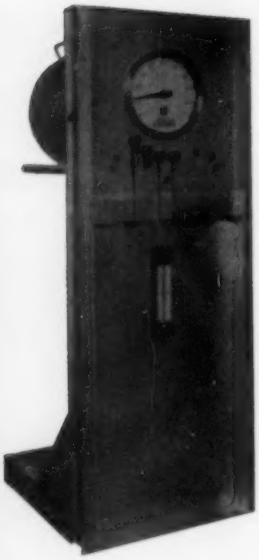

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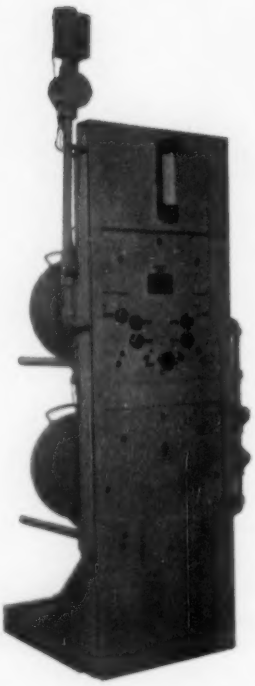

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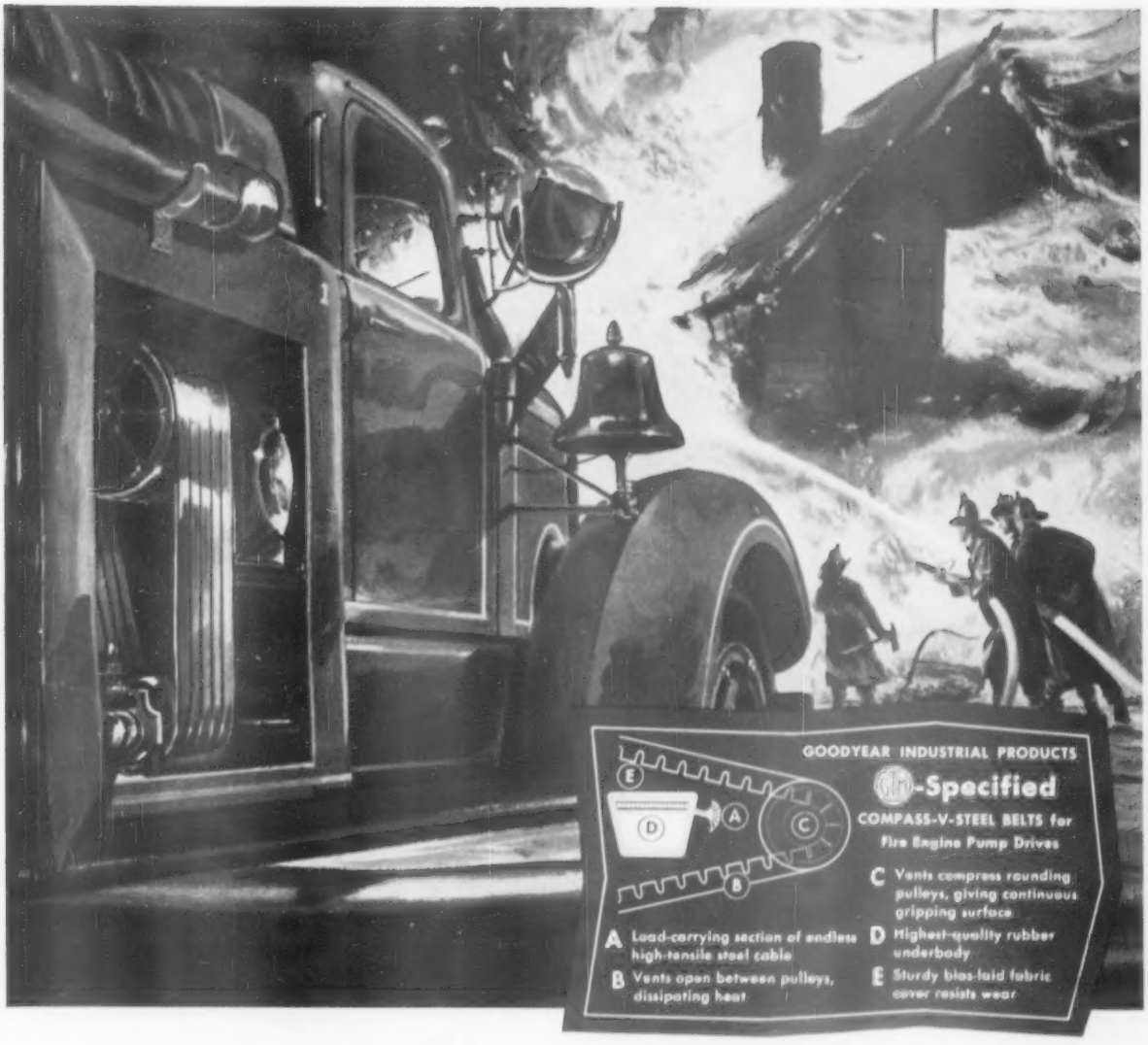
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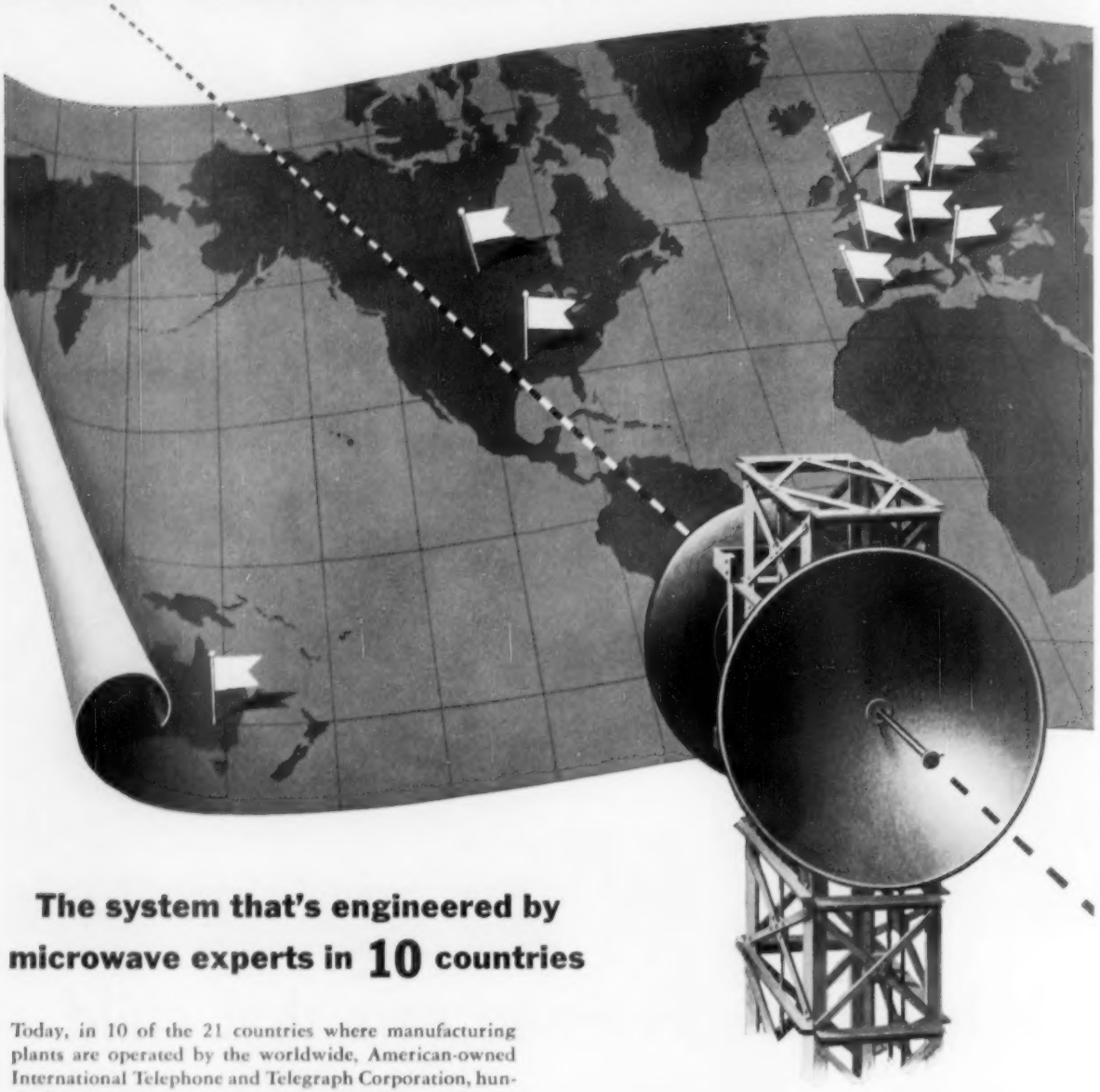

The system that's engineered by microwave experts in 10 countries

Today, in 10 of the 21 countries where manufacturing plants are operated by the worldwide, American-owned International Telephone and Telegraph Corporation, hundreds of microwave experts are engaged in producing standard microwave equipment for installation all over the globe . . . for every climate and terrain.

In 4 of the 10 countries, central laboratories not only contribute by their continuing research to the standard equipment types, but also manufacture custom-designed equipment for special microwave requirements.

It is from this immense and ever-growing source of international experience that *Federal* Microwave draws its superior technical, economic, and performance features . . . now providing complete communication facilities, including push-button control of many remote operations, to industry in 27 states.

Federal is microwave at its simplest and best . . . designed, engineered, and built by the skill that gave the world its *first* commercial microwave and pioneered so much of its later development. It is the only system that is *"Certified by a World of Research!"*

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Federal Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

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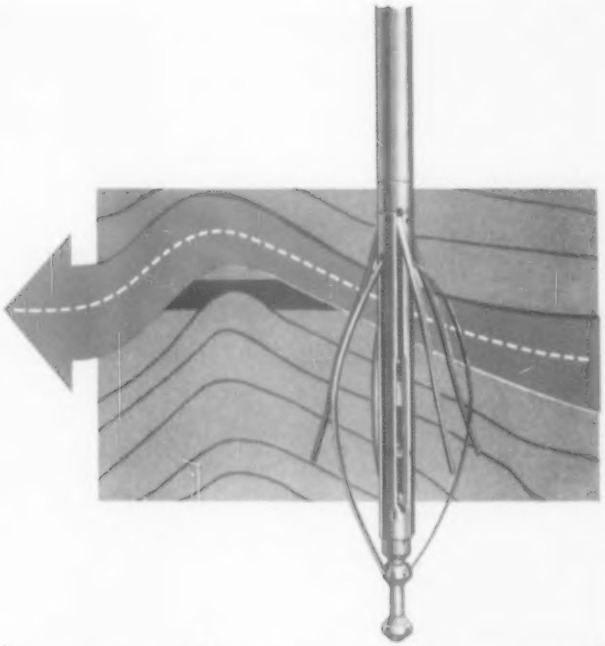
In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., New York

REPRODUCIBLE ACCURACY ELIMINATES GUESSWORK



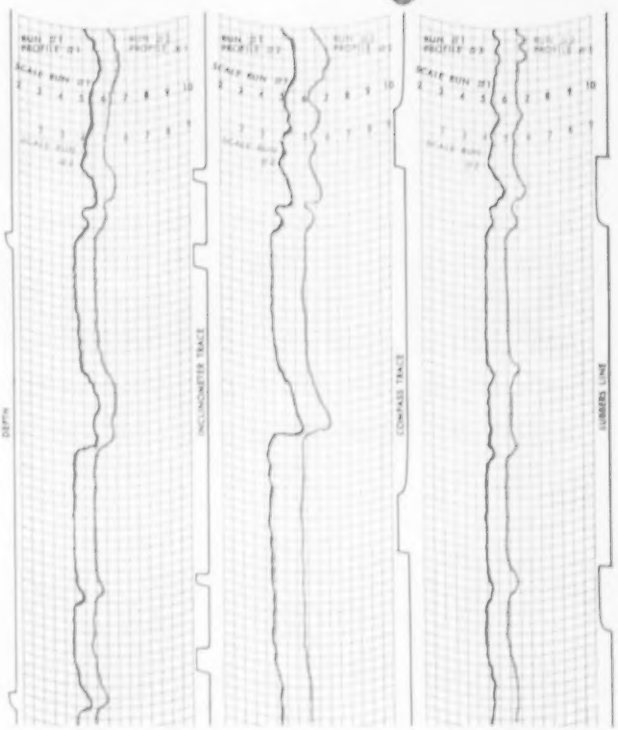
DIP LOG DATA

PERMANENT RECORD FOR DEVELOPING PRODUCTION

The accuracy of the recording, interpretation and computing systems of Halliburton's Dip Log is shown by the reproducibility of results obtained in repeat surveys of the same well. Even small erosional features of only ¼" relief are precisely duplicated in repeat runs while extremely low angle dips can be calculated with a consistent accuracy of ±1°.

With this extra accuracy and with the advantage of a continuous survey, the Dip Log provides a permanently useful record for determining the dip and strike of subsurface formations. The data can be used immediately for locating wells up structure and developing the reservoir of a productive test or can be filed for future study of hole sections not initially considered important.

Halliburton's system of continuous, physical Dip Logging gives you a factual and accurate guide for developing new production. For the Dip Log and other advanced logging tools that give you more help with greater economy, call your local or district office of the Halliburton Oil Well Cementing Company.



Run #1 was made immediately after Run #2 with the profile arms displaced 20° between surveys. The same depth interval is shown with the radius scale on Run #2 displaced one inch to allow detailed comparison. The reproducibility of results obtained is of particular interest, since the erratic lithology and subsequently erratic erosional profile poses the most difficult conditions. The seven traces are simultaneously recorded and all data is transmitted by means of Halliburton's FM System.

HALLIBURTON

ELECTRICAL WELL SERVICES

211 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

a 20-year project lets you

SET IT and FORGET IT

advances in MM engine design keep pace with oil industry's greater performance demands

To *set* power and *forget* it demands superior on-the-job serviceability *and* service.

Minneapolis-Moline *serviceability* means super long-run dependability . . . a 20-year improvement project that has kept pace with stepped-up performance requirements of the oil industry.

Months and years of continuous unattended operation on oil field pumping jobs attest to the success of MM's exclusive maintenance-saving design. Part size, weight and displacement of MM engines increases with h.p. Cylinder blocks and heads are cast in removable pairs separate from the crankcase to simplify service and renewal. Crankcases have extra depth below center line of crankshaft for greater rigidity and bearing support, offer metered vacuum ventilation for longer lube oil life. Thermo-clad protection with bypass cooling and water-blanketed base pans provide complete temperature control.

In addition to MM long-run advantages, you cut operating costs with SECO flat-rate contract maintenance. Compare this SECO flat-rate service contract with your present service charges for hourly pay, mileage, etc., and see how maintenance costs go down. Exclusive MM SECO service by Shrimpton offers a complete engineering, installation and maintenance program that means you can literally "set it and forget it". Discover the big, two-way savings you can make with long-run MM engines serviced by SECO. Contact your MM oilfield distributor for the facts.

INDUSTRIAL MM MODERN MACHINERY DIVISION

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2 COMPLETE LINES for Faster, Safer, More Convenient Liquids Handling . . .

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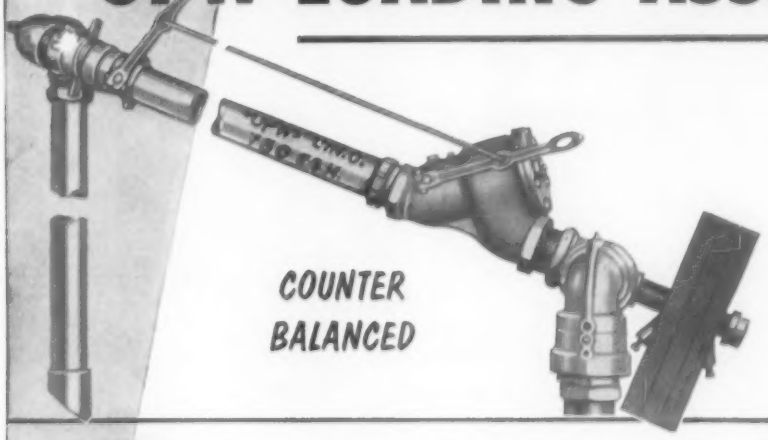
OPW LOADING ASSEMBLIES



Oil and chemical companies alert to reducing tank car and truck loading and unloading time without jeopardizing safety standards and contaminating product are converting daily to the trouble-free operation of OPW LOADING ASSEMBLIES.

Behind this industry acceptance are several determining factors:

- **COMPACTNESS**
- **CONVENIENCE**
- **FAST DELIVERY**
- **SMOOTH OPERATION**
- **LONG SERVICE LIFE**
- **MINIMUM PRESSURE DROP**

CATALOG F-7 OG provides sizes, engineering data and specifications on all OPW Spring-Balanced and Counter-Balanced Loading Assemblies. Free on request.

OPW CORPORATION 2731 Colerain Ave., Cincinnati 25, Ohio

For Dependable
DIAMOND
CORES

ROTARY SPEED Control Is Essential

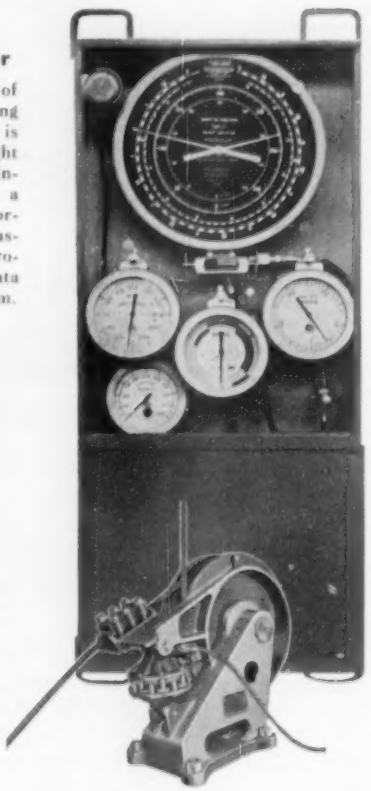
The use of an instrument to measure rotating speed of the drilling string is very important. The wide range in drilling speeds now being used and the importance of coordinating specified table speeds with specified weights carried on the bit to secure maximum efficiency in drilling different formations or meeting other drilling demands make the use of a Tachometer essential.

Dependable cores provide the most valuable data on new wells. The geologist must know what is being cut when a core barrel is run. And, as a large percentage of cores are taken with expensive diamond core heads, costing from $2,500 to $8,000 each, it is essential that every possible precaution be taken to secure diamond cores that are truly informative.

The only way you can get 100 feet of core recovery from 100 feet of drilling is through instrumentation.

The Martin-Decker Rotary Table Tachometer

Furnishes the ideal means of maintaining uniform rotating speed. When this instrument is used in a Martin-Decker Weight Indicator Combination, which includes a Weight Indicator, a Torque Gauge, and other important instruments, all in one master panel, the geologist is provided with all the necessary data for a coordinated drilling program.



ACCURACY INFINITELY INCREASED WITH SENSATER

The E-80 Sensater (shown in Ideal anchor at right) is now standard equipment with all Martin-Decker Type "D" and "E" Weight Indicator and Ideal Wire Line Anchor combinations. The Sensater is a diaphragm that strokes like a piston, but with no friction whatsoever, thereby giving weight-indicator accuracy never before thought possible.

Know Your Weight, Speed and Torque At All Times

You can't afford to gamble. Know precisely what you are doing on bottom. Don't lose diamonds in the hole by using too much weight. The Martin-Decker Weight Indicator furnishes the data you need to safeguard this operation. Don't jam the cores and burn the heads by setting on the matrix and spinning with too much rotating speed when coming out of a hard formation into a broken slate or shale formation. The Martin-Decker Rotary Table Tachometer provides the answer to this problem. Don't break your cores with too much torque. The Martin-Decker Torque Gauge gives information for preventing this trouble. And all three of these essential gauges plus several other valuable ones are combined in Martin-Decker Weight Indicators and Wire Line Anchors to provide the ultimate in accurate-sensitive-dependable DRILLING CONTROL and WIRE LINE ANCHORING.

"D", "E" and "F"
COMBINATIONS
Accurate Under All Conditions

Positively unaffected by temperature changes, leaks or variations in fluid volume.

There are three combinations

The TYPE "D"
For a Dead Line Load of 60,000 lbs.

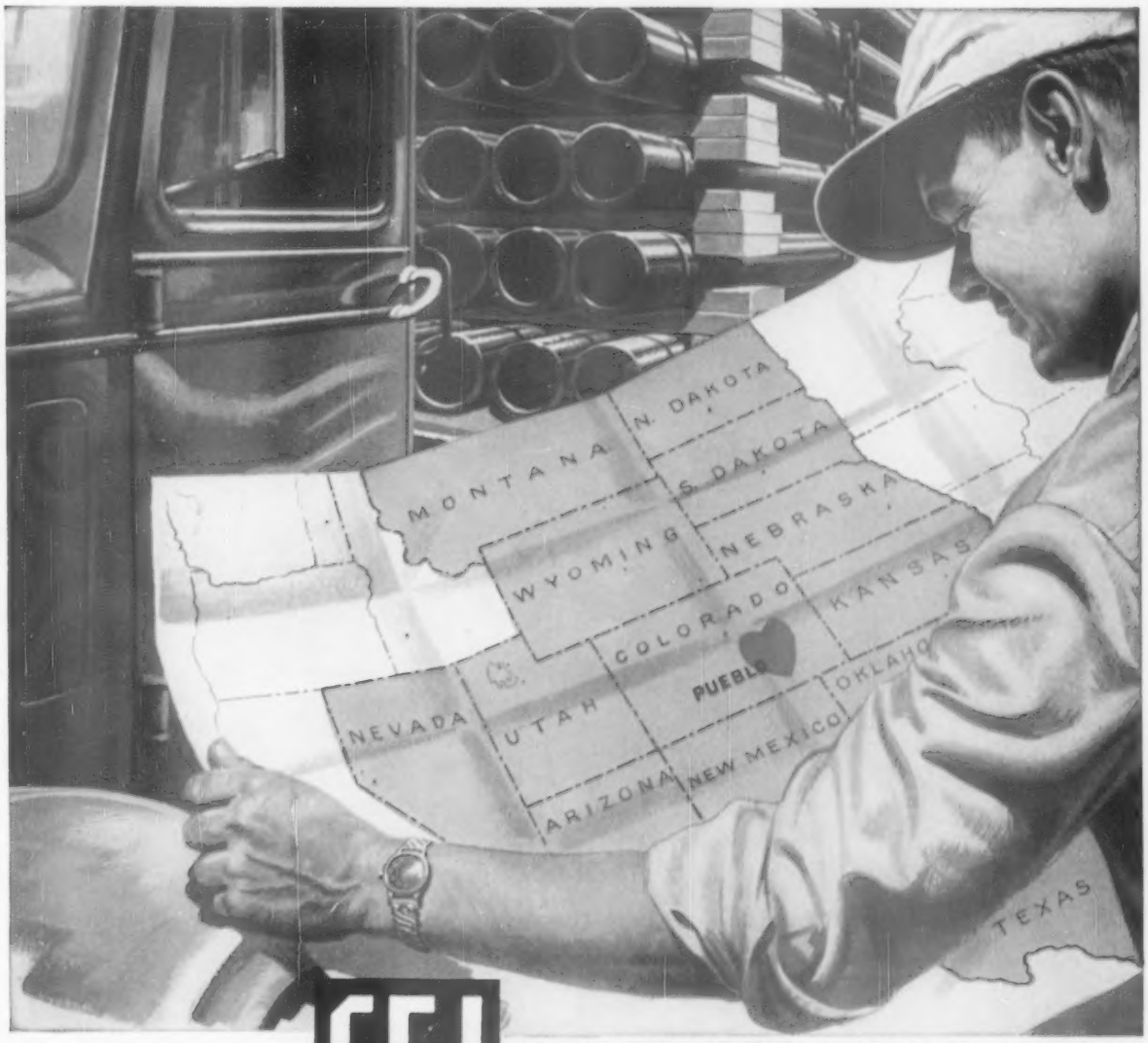
The TYPE "E"
For a Dead Line Load of 90,000 lbs.

The TYPE "F"
For a Dead Line Load of 40,000 lbs.

In Use The World Over

MARTIN-DECKER CORP.
HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

SAN JOAQUIN VALLEY: T. J. CULLEN, BAKERSFIELD, CALIFORNIA
MID-CONTINENT DISTRIBUTOR: REED ROLLER BIT COMPANY, HOUSTON, TEXAS
CANADIAN DISTRIBUTOR: REED ROLLER BIT COMPANY OF CANADA, CALGARY & EDMONTON, ALBERTA
MARTIN-DECKER WEIGHT INDICATORS AND IDEAL WIRE LINE ANCHORS ARE ALSO SOLD THROUGH THE NATIONAL SUPPLY EXPORT CORP. THE NATIONAL SUPPLY CO. AND OTHER RECOGNIZED SUPPLY HOUSES



THE NEW CF&I SEAMLESS TUBE MILL

set in the heartland of the oil country

Here at Pueblo, Colorado, stands the new C F & I Seamless Tube Mill — strategically located in the heartland of the Western oil country to give prompt on-the-spot attention to the needs of oil and gas companies in the Rocky Mountain and Southwest areas.

The new C F & I Seamless Tube Mill is the newest mill of its kind West of the Mississippi. To all members of the petroleum industry we extend a cordial invitation to inspect the modern facilities and advanced inspection techniques which now assure you of casing and tubing that are tops for precision and quality.

C F & I Seamless Oil Country Casing and Tubing meet API STD 5A specification and are available in sizes from 2⅜" O.D. through 9⅝" O.D.

2465

CF&I TUBULAR PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION

DENVER, COLORADO

CF&I

Baroid's Man-Tan

most economical chemical thinner

Baroid's MAN-TAN, field tested for over four years, is giving more mud thinning per dollar than any other tannin thinner now offered. MAN-TAN costs less than quebracho, mixes easily, and works efficiently.

Use MAN-TAN to reduce viscosity, gel strength, and filtration.

MAN-TAN CUTS MUD COSTS IN ALL AREAS

Houma, Louisiana: Average of 20% reduction in mud costs on seven wells using MAN-TAN. (Ratio: 2:1 MAN-TAN – caustic soda.)

Oregon Basin, North Central Wyoming: MAN-TAN successfully used in same 2:1 ratio, replacing more expensive thinners.

Daggett County, Utah: Another success case, using MAN-TAN in 2:1 ratio with caustic.

Iberia Parish, Louisiana: MAN-TAN, a successful thinner on 14,400-ft. well, with 43% savings in mud and chemical cost.

Similar successful use of MAN-TAN is reported from such widely separated areas as Wyoming, West Texas, North Louisiana, Mississippi, North Texas, and New Mexico. Specify MAN-TAN now wherever a tannin chemical mud thinner is needed. Write today for new bulletin giving complete technical details.

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BAROID P. O. Box 1675, Houston 1, Texas

Please send me the latest technical literature on Man-Tan.

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We're tipping our hat to line pipe men!

HERE'S A tip of our hat and a thank you to you line pipe men for the confidence you have shown in us.

In the past four years you've demonstrated your confidence in us by ordering more than 24,000 carloads of Basalt-Kaiser steel line pipe for major projects the country over. This is enough to build a pipe line from Juneau, Alaska to the Panama Canal.

It's good to know we've earned this confidence by delivering all of this steel line pipe *on time* . . . and by assuring you *uniform quality* and *prompt service*.

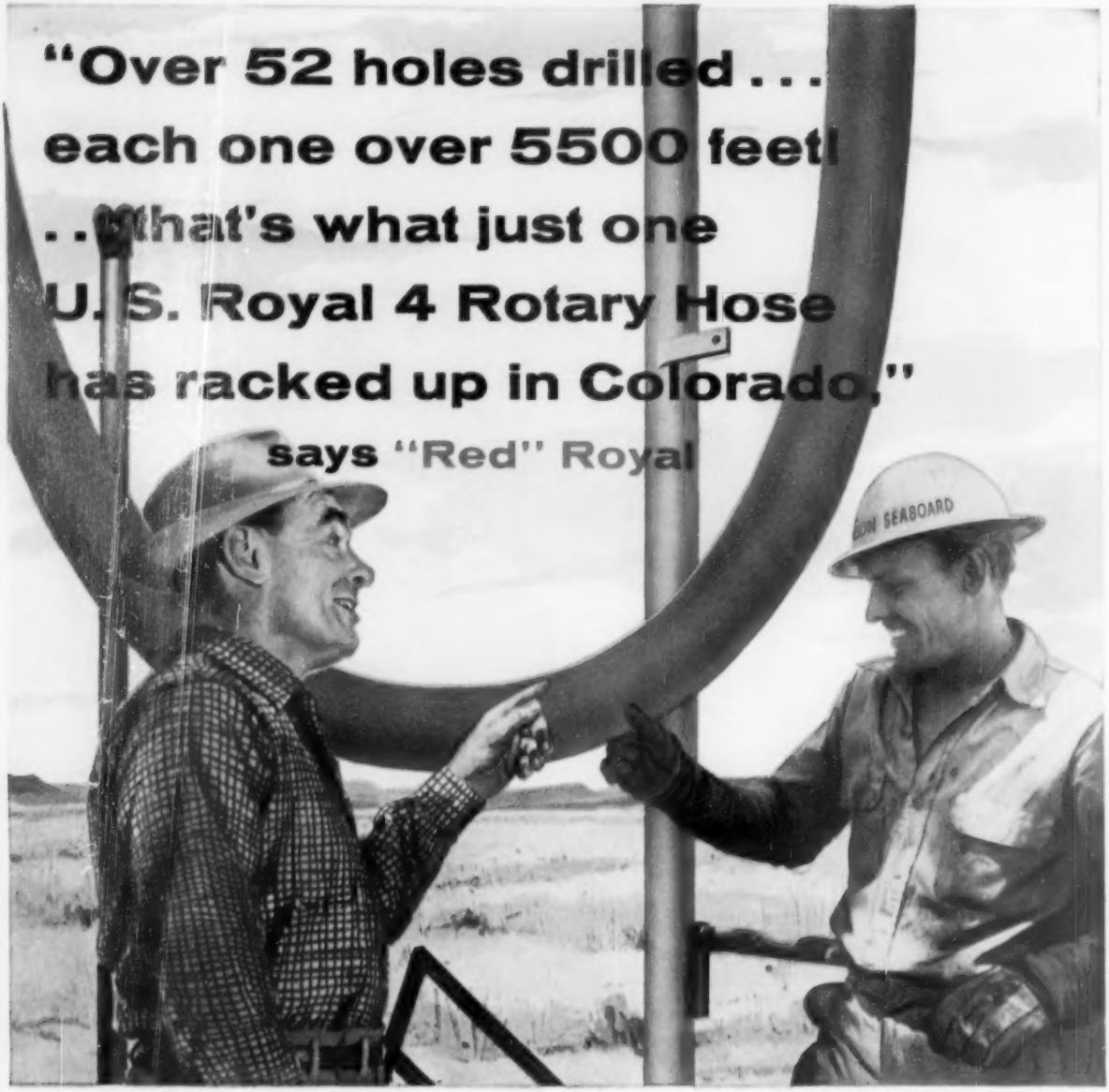
Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	⅛" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Phoenix, Denver, Tulsa, New York

"Over 52 holes drilled . . . each one over 5500 feet! . . . that's what just one U. S. Royal 4 Rotary Hose has racked up in Colorado," says "Red" Royal



"Red" Royal knows the story well. His friends, Zack Taylor (drilling superintendent) and Bud Swain (driller) of Falcon-Seaboard Drilling Co., handled these jobs. The U. S. Royal 4 Rotary Hose (Serial No. 1-250) was put in service in July, 1951, and is still on the job today, *four years later.*

You can bet that "Red" Royal would never be caught buying inferior hose that wastes his drilling dollars. Experience after experience, in field after field, demonstrates that no hose can match the service records piled up by U. S. Royal 4. It's the hose that handles the highest pressures on today's pumps—it's used all the way from spud to pay.

Developed by Science—Proved by Drillers

Available in all fields at supply stores

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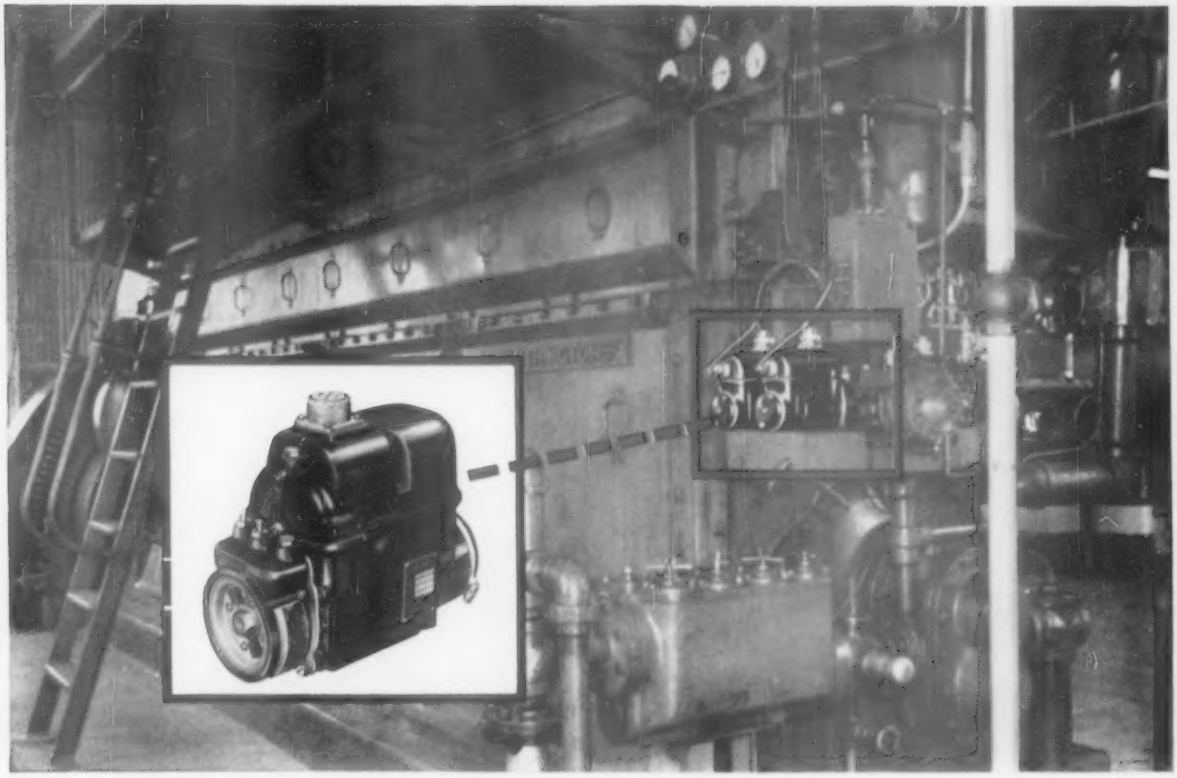

Meeting boom-town demand 24 hours a day—365 days a year

Worthington Natural Gas Unit with

Farmington, New Mexico, became a boom town overnight. A Worthington natural gas engine equipped with Bendix LAR Magnetos played a vital part in this rapid expansion by supplying more than 53% of the total kilowatt-hours generated by the local power system.

There is no room for an outmoded ignition system in today's fast-moving economy. Engine operators just can't afford to put up with uneven engine performance, high exhaust temperature, heavy maintenance schedules and excessive downtime.

The modern LAR Magneto and its companion high output coil give the kind of reliable ignition that saves money. Reserve power insures smooth-running engines even under the most adverse conditions, where marginal systems fall down.

The striking example of endurance of the Farmington installation is just one more reason why leading manufacturers choose Bendix—the most trusted name in magnetos.

Kits are now available to convert your LA Magneto to the modern LAR type at surprisingly low cost. Complete details are available either from the factory or our authorized distributors.

Bendix

MAGNETOS!

SCINTILLA DIVISION, BENDIX AVIATION CORP., SIDNEY, N.Y.

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Bendix
SCINTILLA DIVISION

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AVIATION CORPORATION

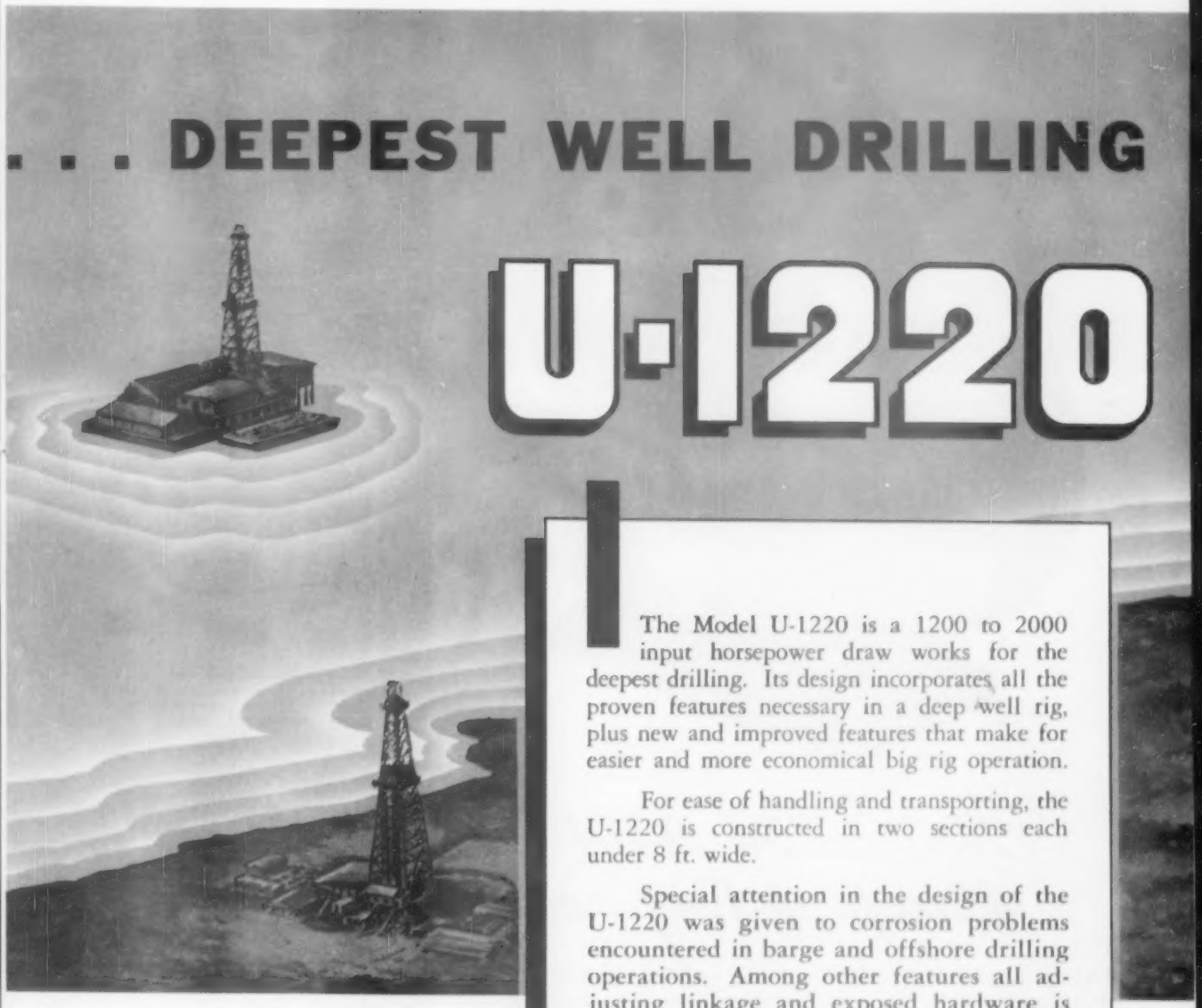
A NEW RIG FOR . . . . .

UNIT U-1220

- Extra large drum. 32¼" x 57" long barrel.
- Six hoisting and three rotary speeds. A gear reverse drive for drum and rotary is standard.
- Fully enclosed water circulating 60" x 10⅜" heat treated, rolled forged alloy steel brake rims.
- Provision for driving a "feed-off" device.
- 42" Ventorque high and low drum clutches with provision for positive drive.
- 60" hydromatic brake direct connected to drum shaft with overrunning clutch.
- All chain drives are standardized to 1¾" pitch and all are oil bath lubricated.

UNIT

. . . DEEPEST WELL DRILLING



U-1220

The Model U-1220 is a 1200 to 2000 input horsepower draw works for the deepest drilling. Its design incorporates all the proven features necessary in a deep well rig, plus new and improved features that make for easier and more economical big rig operation.

For ease of handling and transporting, the U-1220 is constructed in two sections each under 8 ft. wide.

Special attention in the design of the U-1220 was given to corrosion problems encountered in barge and offshore drilling operations. Among other features all adjusting linkage and exposed hardware is protected by special plating. This, plus its highly portable feature make it well suited for either off shore or inland work.

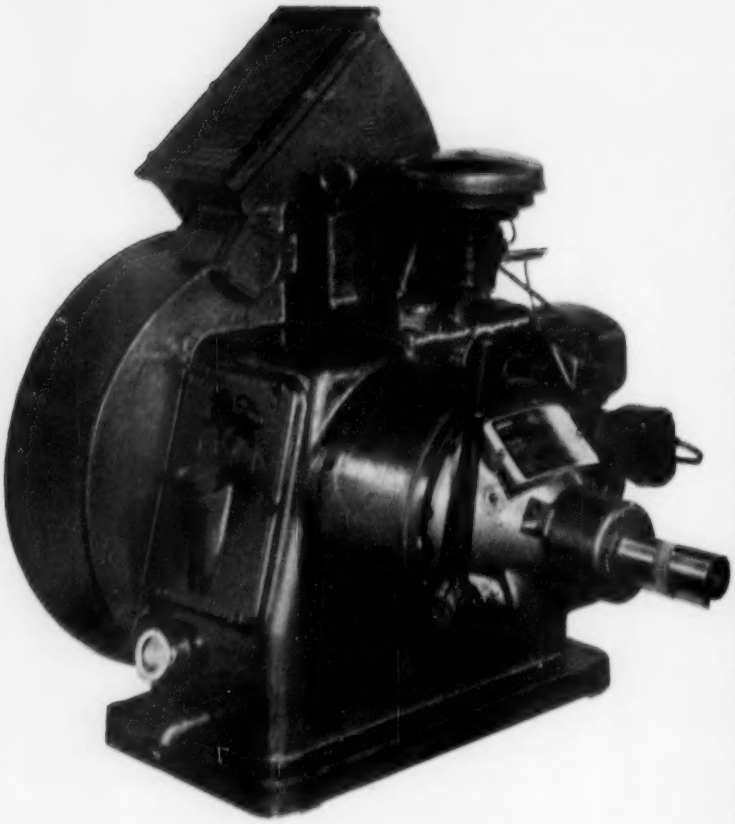
Write for complete information on the new U-1220

UNIT RIG & EQUIPMENT CO.
TULSA, OKLAHOMA U.S.A.

UNIT RIG & EQUIPMENT CO.
TULSA, OKLAHOMA, U.S.A.

UNIT RIG & EQUIPMENT PRODUCTS ARE SOLD THROUGH LEADING SUPPLY COMPANIES THROUGHOUT THE U.S.A. AND CANADA

EXPORT SALES — MID-CONTINENT SUPPLY COMPANY 45 Rockefeller Plaza, New York 20, New York Cable — MIDUNITRIG



New LeRoi A114 Pumping Engine

A single-cylinder, valve-in-head engine with 114 cu. in. displacement, built specifically to give you economical operation with little attention.

Here it is — an engine that can pump more oil than any other engine of equal displacement. You can run it two weeks at a time without inspection, because the patented "vaporizing condensing" cooling system seldom needs make-up water. Moreover, a generous crankcase permits long intervals between oil changes, and there are no grease fittings, belts, or other accessories to need attention.

Performance is only half of the A114 story— the other half is dependability. Here are a few of the features that give the A114 its stamina:

The A114 operates on natural gas or LPG.

Get all the facts about this new 14.5 hp pumping engine from your supply house or your Le Roi distributor. Or, write for our latest bulletin E-8.

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 14, Wisconsin

Oilfield Headquarters: Tulsa, Okla.

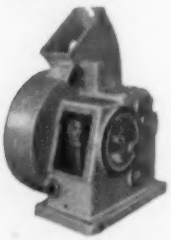
PORTABLE AIR COMPRESSORS • TRACTAIR • STATIONARY AIR COMPRESSORS • AIR TOOLS • ENGINES

P-126

Two extra large flywheels provide generous WR2 values for smooth, constant-speed pumping even with unbalanced loads.

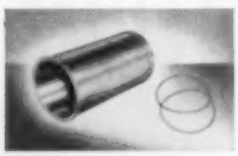
Valve-in-head design produces maximum power with minimum fuel consumption. Short stroke design reduces piston speed and lessens cylinder wear.

Short, counter-balanced crankshaft, 3" in diameter, has extreme overlap between crank pin and main bearing journals for added strength and rigidity.



Heavily constructed and internally ribbed, integral crankcase and base eliminate any possibility of distortion.

One-piece fan and flywheel is totally enclosed in a specially built air duct. No fan or belt to maintain or replace.



Removable, wet-cylinder sleeves assure easy, low-cost replacement of cylinder wearing surface.

Pipe and tool joints are forged as one

J&L INTEGRAL JOINT SEAMLESS DRILL PIPE

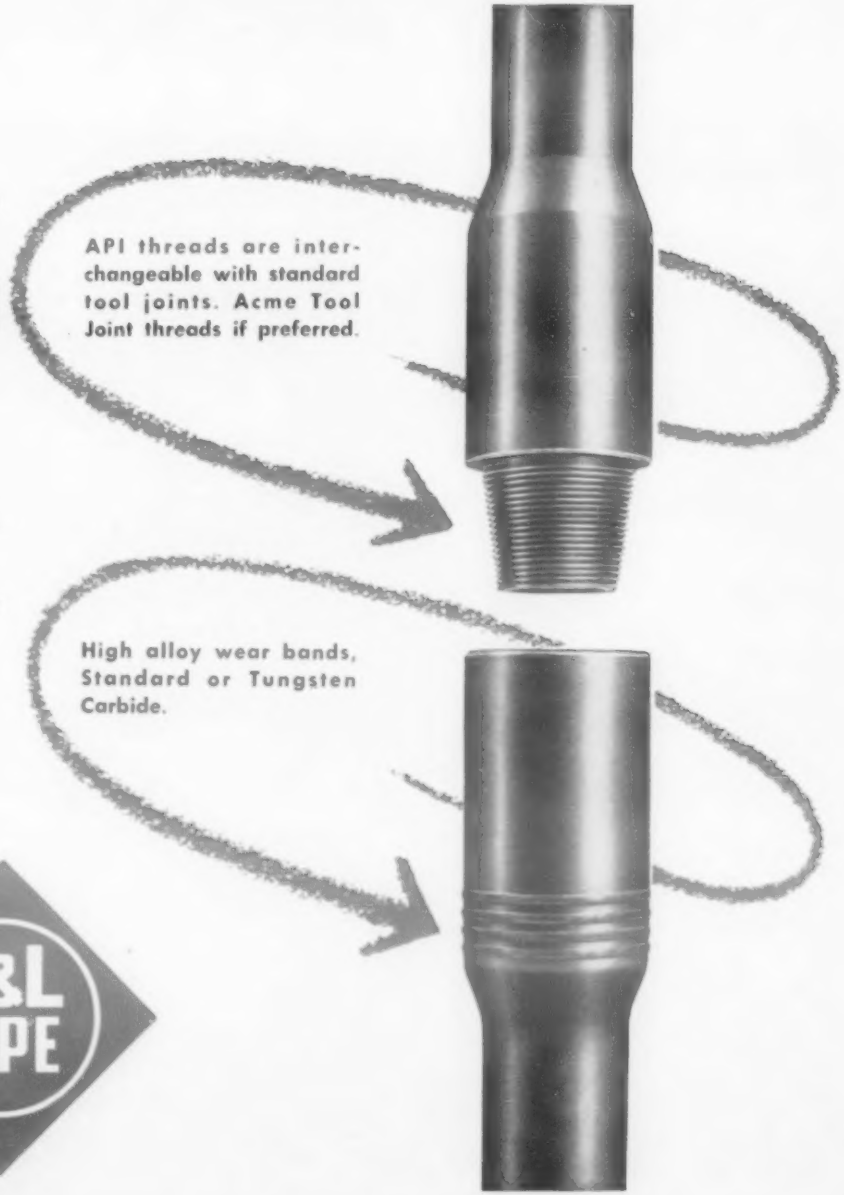
J&L Integral Joint Drill Pipe is made of J&L Blue Ribbon Steel.

Blue Ribbon is the culmination of years of Jones & Laughlin leadership in the manufacture of quality steels.

In producing J&L Integral Joint Blue Ribbon Drill Pipe the steel is made, rolled, formed, forged, heat treated and finished for the man who wants a truly rugged string of drill pipe and tool joints.

Full hole or internal flush design. API or Acme Tool Joint threads. Box and pin ends available with O.D. slightly greater than API standard.

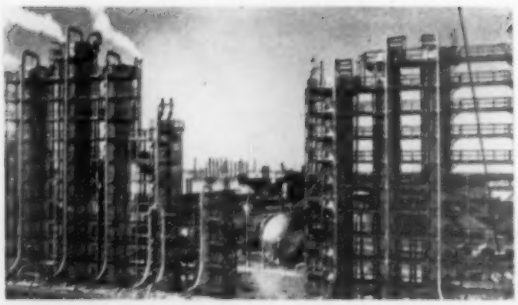
Ask any J&L man for further details.


API threads are interchangeable with standard tool joints. Acme Tool Joint threads if preferred.
High alloy wear bands, Standard or Tungsten Carbide.

Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION – TULSA, OKLAHOMA
Serving The United States and Canada

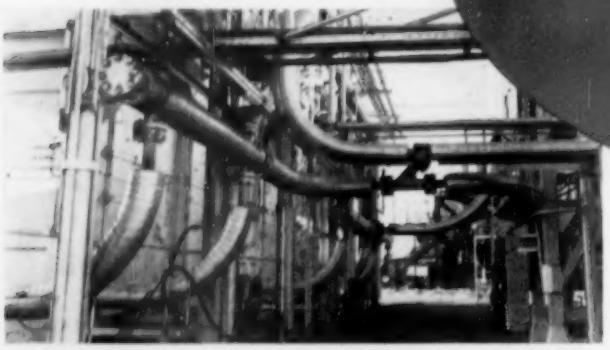
J&L PIPE

NO WEAKNESS HERE. These welded seams will last as long as the walls themselves—they'll last indefinitely. ENDURO retains its great strength through scorching heat or sub-zero temperatures. Explosive force and punishing pressure are held in check.



SAVE WEIGHT AND GAIN SPACE. ENDURO's exceptionally high strength-to-weight ratio and fatigue resistance open new refinery design opportunities. For example, thinner, lighter ENDURO sections simplify fractionating tower structural problems —without loss of strength, without sacrifice of safety. Yet, with long life assured at the lowest ultimate cost.

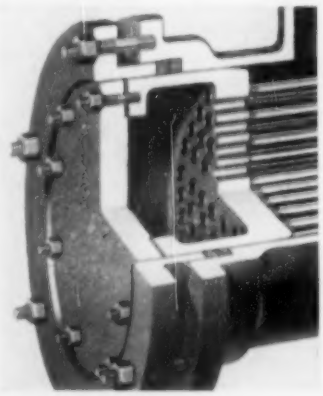
Look at the ways ENDURO® can reduce your maintenance and replacement costs



WHERE CORROSION CREATES A MAINTENANCE PROBLEM there's a definite need for equipment made from ENDURO—like these charging lines. ENDURO stubbornly resists rust and corrosion. Resists the action of most alkalies and acids. These advantages add up to longer equipment life, less maintenance, man-hours saved, less down-time, higher productivity.

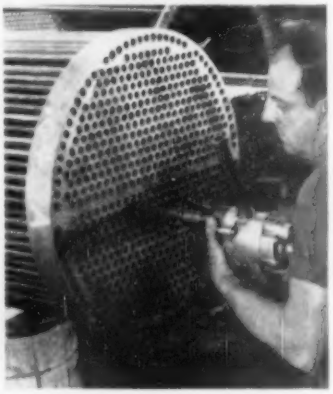
Republic ENDURO Stainless Steel is reducing costs on hundreds of refinery applications. Why? Because stainless steel fights corrosion as does no other commercial metal. It discourages coking and fouling. Saves weight and bulk. Is tough and strong. Resists temperature extremes. Stays easy to clean. Lasts indefinitely.

Pictured on these pages are just a few applications showing ENDURO's ability to reduce maintenance and replacement costs throughout the refinery. For complete information on what ENDURO Stainless Steel can do for you, mail the coupon.



STRENGTH YOU CAN RELY ON under severe heat, pressure and corrosive conditions are but one feature of Republic Alloy Steel Studs. Clean accurate threads provide maximum holding power, resistance to wear, easy tightening, trouble-free backoff for maintenance. Specify Republic Alloy Steel Studs on new equipment. Carry them in stock for replacement.

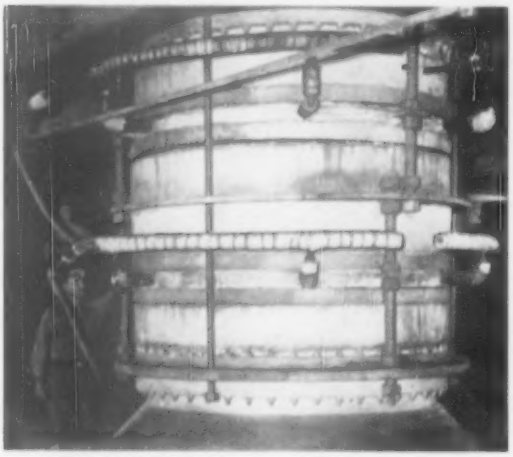
GET MORE PRODUCTION WITH LESS DOWN-TIME by installing dependable Republic ELECTRUNITE Heat Exchanger Tubes. Uniform diameter means tubes slide into tube sheets easily, quickly. Uniform wall thickness makes them expand evenly with less danger of under or over-rolling. Each length is fully annealed, assuring uniform ductility and corrosion-resistance. Each length must pass rigid tests for conformity to the required specification. Republic's Steel and Tubes Division supplies ELECTRUNITE Heat Exchanger Tube in either carbon or stainless steels.



STRENGTH TO RESIST HIGH PRESSURES. This giant is made from ENDURO Stainless Steel. Refinery heat will have little effect upon it. Neither will corrosive fumes and chemical processing solutions. ENDURO meets all "cracking" requirements and adds long service life as an extra benefit. Equipment made from ENDURO requires minimum maintenance or repair.

COKING AND FOULING ARE DISCOURAGED when bubble caps and trays are made from ENDURO. Bubble towers stay on-stream longer. Cleaning time and maintenance costs are reduced to a minimum. ENDURO's high strength-to-weight ratio and ease of fabrication permit thinner, lighter sections. More teeth per cap are possible. The result is more intimate liquor-vapor mixture on the tray—and sharper fractionation.

LESS COST PER YEAR OF SERVICE in all types of refineries is a proved fact. Equipment fabricated from ENDURO, like this two-stage cyclone unit, lasts and lasts. While ENDURO's initial cost may be somewhat higher than less resistant materials, immediate savings in maintenance costs, less down-time for cleaning and repairs, and longer equipment life soon cancel out extra cost and then result in savings.



HIGH HEAT IS NO PROBLEM FOR ENDURO. It resists scaling in high temperature applications. Possesses high creep strength. Stubbornly resists the corrosive action of most hot or cold alkalies and acids. ENDURO-made equipment—expansion joints, cracking stills, heat exchangers, tubes, valves, pumps to name a few—can be counted on for fewer production interruptions with substantial savings in both maintenance and replacement costs.

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Please send information on:

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Company_____

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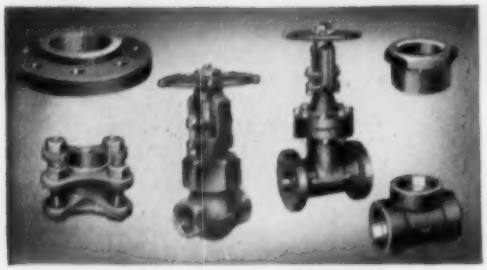
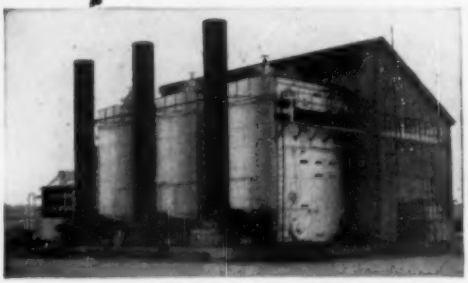
Designed for today's *Tough* service demands



DROP FORGED VALVES AND FITTINGS FOR TOUGHNESS AND TROUBLE-FREE SERVICE

Drop forged from carbon and alloy steels, Vogt valves, fittings and flanges will safely handle liquids and gases at high pressures and high temperatures in power plants, chemical plants, petroleum refineries, etc. The complete line includes flanged, screwed and socket weld end globe, gate and check valves—ells, tees, and crosses—couplings—bushings—plugs—unions—flanges and flange unions—and welding heads.

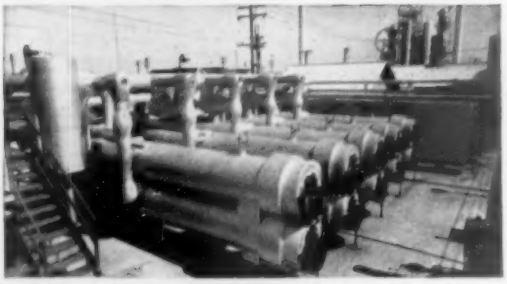


MODERN STEAM GENERATORS

Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels meet every power, process or heating requirement.

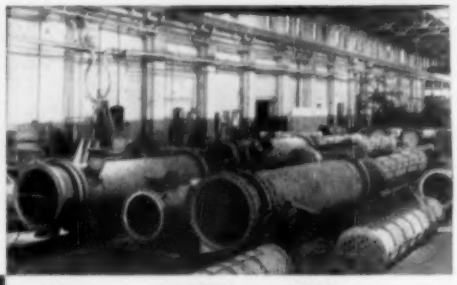
PROCESS EQUIPMENT FOR EVERY SERVICE

Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.



SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.



MORE REFRIGERATION TONNAGE AT LESS COST

More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Absorption Systems, Compression Systems, and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants, and institutions, here and abroad.

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Dimetcote is absolutely unique. It is not a paint, it contains no oils, resins or any other organic materials, yet it can be applied by spray or brush. When Dimetcote is applied to steel, a reaction takes place at the surface which produces chemical bonding as well as physical adhesion. It is almost impossible to find the interface between Dimetcote and the steel.

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Now tanks and structures can be given the same protection that galvanizing affords, *plus salt water resistance*. Existing structures need not be dismantled and new structures can be coated either before or after erection. *Only one coat* of Dimetcote over a sandblasted surface is required to protect such structures as:

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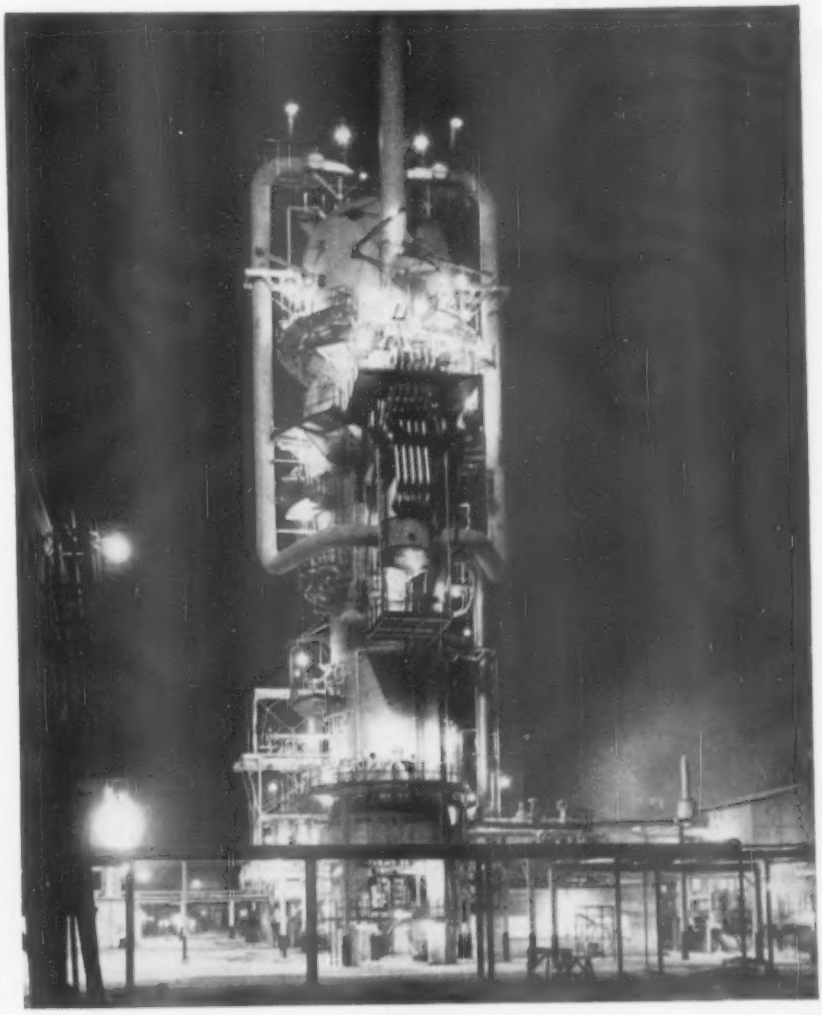
FIRST

IN CAT CRACKING

With over 30 per cent of all crude today eventually becoming cat cracker feed, cat cracker design is increasingly important to refiners. The superiority of the *Fluid* Cat Cracking design is well-established by the fact that 70 per cent of cat cracking capacity in the free world is the fluid design. The M. W. Kellogg Company has engineered or erected more than half of this fluid capacity.

M. W. Kellogg has been in the forefront of Fluid Catalytic Cracking from the beginning. Starting early with continuing studies of catalysts, it worked closely with the industry in engineering the fluid principle. M. W. Kellogg's contribution in mechanical engineering made it possible to design units of capacities large enough to meet accelerated demands for higher octanes since World War II. Its long experience in constructing oil refineries enabled M. W. Kellogg to undertake the erecting of these initial units, and the even larger ones in operation today, with full confidence that they would be on stream in minimum time.

An M. W. Kellogg Fluid Catalytic Cracking unit is your guarantee of many predetermined requirements, including throughput capacity, product quality and quantity, utility cost, catalyst loss, and coke-burning capacity. From its experience in engineering and erecting many side-by-side units, M. W. Kellogg originated



The distinctive vertical construction of M. W. Kellogg's Orthoflow Fluid Catalytic Cracker—a logical development from the side-by-side model—is becoming more and more familiar on refinery skylines. Orthoflow units completed or under construction since 1951 already represent a total throughput of over 290,000 BPD.

the straight-line Orthoflow* design—which offers many extra economic advantages.

A full-color, 13-minute movie, showing how the Orthoflow works, is now being booked for showings after July 1. Return coupon for particulars and to obtain a copy of our No. 2, 1955 Kelloggram which illustrates a recent Orthoflow installation.

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☐ Send available dates for showing of your new Orthoflow film.

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IT'S CROOL T' STUFF THAT CRITTER IN A HOLE!!
WE HEARS CATS' WHISKERS MEASURES OIL-WELL INSIDES!!-
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NO!!-YOU HEARD THE JOHNSTON HYDRAULIC HOLE CALIPER IS THE CAT'S WHISKERS, FOR CHARTING BORE-HOLE DIAMETERS!!
IT LOGS SUB-SURFACE FORMATIONS, TO GIVE AN ACCURATE PROFILE-
SPEAKIN' O' PROFILES, YO' JOHNSTON BOYS GOT MIGHTY HAN'SOME ONES!!-
SORRY!!-WE GOTTA LOG A WELL, WIF THAT CALIPER THAT SAVES RIG-TIME!!

C-5411

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A Primer of Gas Turbine Engines

What is the man above holding?

He is holding a Solar "Mars" gas turbine engine. Its power output runs to 50 hp, but it weighs less than 100 lb and is smaller than a two-foot cube. It achieves this remarkable power-to-size ratio by running at a high speed: the shaft in this engine turns at 40,000 rpm!

What advantages do small gas turbines offer?

Gas turbines are extremely light and compact; they permit smaller space envelopes and easy transportation, so important in such applications as portable fire pumps and airborne generator sets (photo above). Gas turbines are simple and rugged, with low maintenance cost. They need no cooling system and will operate on a variety of fuels. Low initial cost is anticipated, when gas turbines reach volume production.

Where are gas turbine engines being used?

Gas turbines today are finding an increasing variety of uses: in boats, where compactness is important; in airplanes, where light weight is essential; in remote pumping stations, where portability counts; in electric power plants, where reliability must be assured.

What gas turbines are made by Solar?

Today in addition to the 50 hp Mars gas turbine, Solar is producing the 500 hp Jupiter gas turbine (photo above). Its weight installed is under 900 lb—less than one fourth that of a comparable diesel engine!

Mars engines have been adapted to many applications such as fire pumps, starter carts, and welding equipment, and they are in volume production for auxiliary generator sets used on the Douglas C-124C and Lockheed C-121C. Both constant speed Jupiter engines for generator sets and variable speed engines for ship propulsion have been built for the U.S. Navy.

Solar gas turbines are not yet generally available as all current production is going into military uses. Field testing of commercial applications is underway and production for civilian use is anticipated in the near future. Further information is available on request.

SOLAR
AIRCRAFT COMPANY
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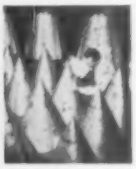
DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF METAL ALLOY PRODUCTS

This is What Solar Offers You

When heat, corrosion or difficult specifications are problems, Solar can help you solve them. Solar specializes in the manufacture of precision products from alloys and special metals for severe service. Solar's experience since 1927 is unduplicated in this field.



SPECIAL PRODUCTS

Gas Turbines. *Solar "Mars" 50 hp engines for auxiliary generator sets, ground carts, portable fire pumps; Solar "Jupiter" 500 hp engines in variable and constant speed models.*

Bellows. *"Sola-Flex"® bellows and expansion joints in many designs from ⅛ in. up to the world's largest, 28 ft in diameter.*

Controls. *Complete control systems utilizing the new Solar "Microjet"® principle for control of gas turbines, jet engines and pneumatic devices.*

CONTRACT PRODUCTION

Current orders include aircraft engine and airframe parts, pneumatic ducting, atomic energy components. Customers include the finest aircraft and industrial companies in the U.S. and Europe.

Plants. *In San Diego and Des Moines (photograph above). A total of 1,400,000 sq ft of floor space. Approximately 5,000 employees. Annual sales over $65,000,000.*

Services. *Research, design, development and production engineering staffs. Experienced with all alloy steels, stainless alloys, super alloys, and titanium and its alloys.*

Facilities . . . *for all types of metal fabrication—forming, machining, welding, brazing, casting, coating. Equipped for prototype, limited or mass production. Extensive laboratories. Complete quality control.*

INFORMATION

For more information regarding Solar Gas Turbines or any Solar product or service listed above, write Solar Aircraft Company Department B-26 San Diego 12, California

7 Reasons Why

. . . PARKERSBURG Single Tube Horizontal Separator is Superior to two tube designs.

20% slower gas flow than in two tube designs assures more effective natural separation.

20% greater interface area provides more thorough and complete de-gassing.

Longer retention time allows more time for oil to give up its gas.

Freezing problem minimized because warm gas stream is in contact with liquid.

Easier to clean because there is just one tube to clean, unobstructed along bottom, with three drains instead of one.

Hairline accuracy of liquid level maintained by exclusive No-Bleed Liquid Level Controller.

Easier unitization — basic Parkersburg one tube can be economically and effectively adapted for two stage and three-phase separation.

● Why not put these 7 benefits of the Parkersburg Single Tube Horizontal Separator to work for you.

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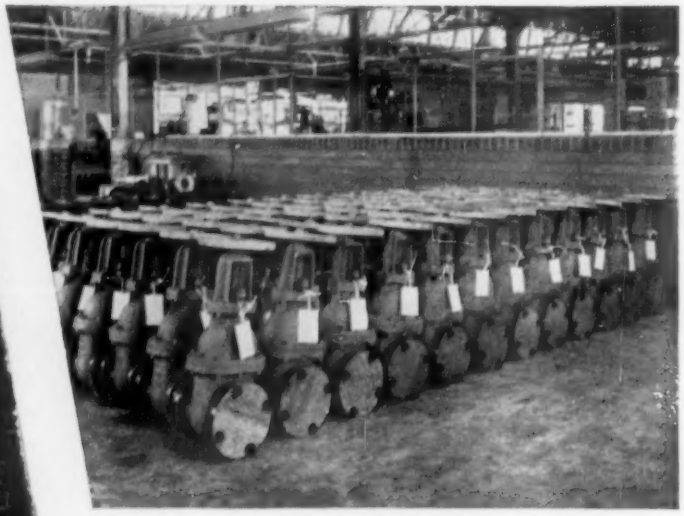
VALVES and FITTINGS for the OIL and ALLIED INDUSTRIES



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G-E electrical systems for refineries are . . .

EASY TO EXPAND

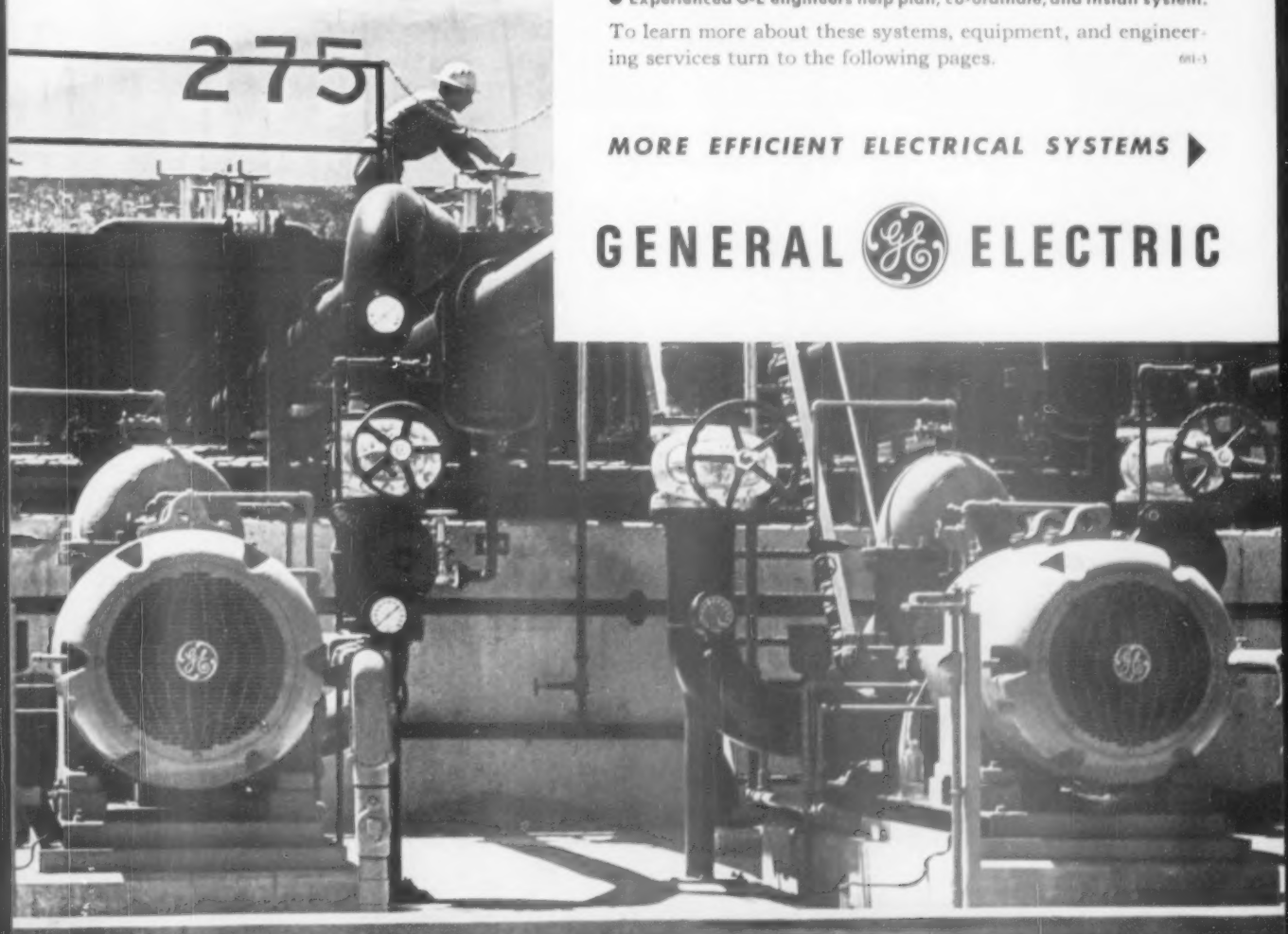
Easy to expand General Electric electrical systems will help make modernization or expansion programs in petroleum refineries more economical. Here's why:

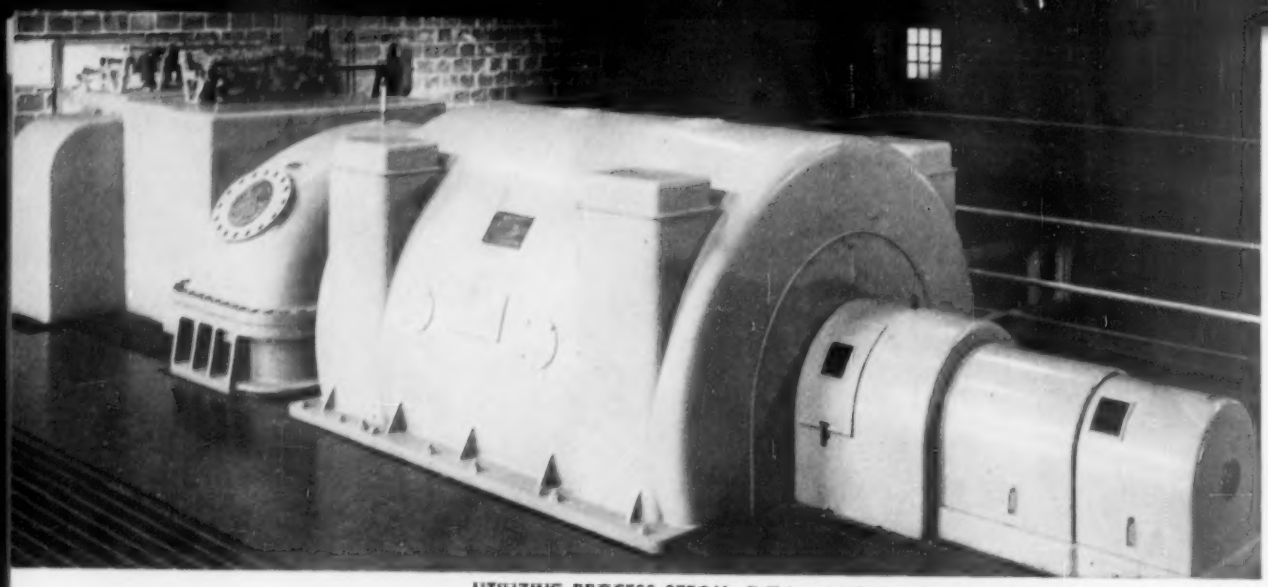
- **Flexible G-E system design simplifies the addition of new equipment.**
- **Versatile G-E equipment is easily incorporated into existing system.**
- **Experienced G-E engineers help plan, co-ordinate, and install system.**

To learn more about these systems, equipment, and engineering services turn to the following pages. 661-3

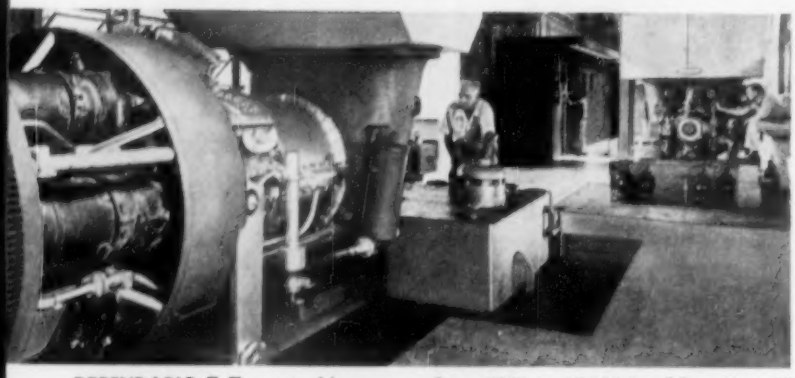
MORE EFFICIENT ELECTRICAL SYSTEMS ▶

GENERAL ELECTRIC

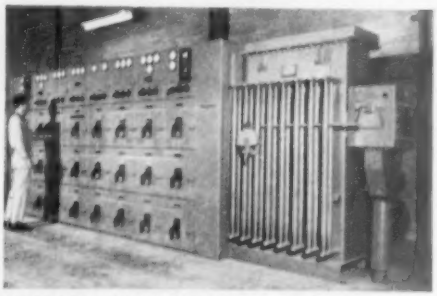




UTILIZING PROCESS STEAM, G.E.'s complete range of steam turbine-generators provide electric power as a by-product, help maintain plant steam balance.



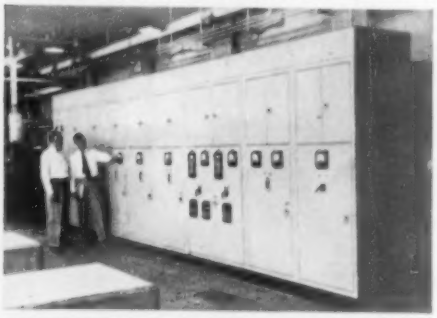
DEPENDABLE G-E gas turbines range from 6700 to 17,000 hp. More than 55 units utilize exhaust heat for power generation and mechanical drive applications.



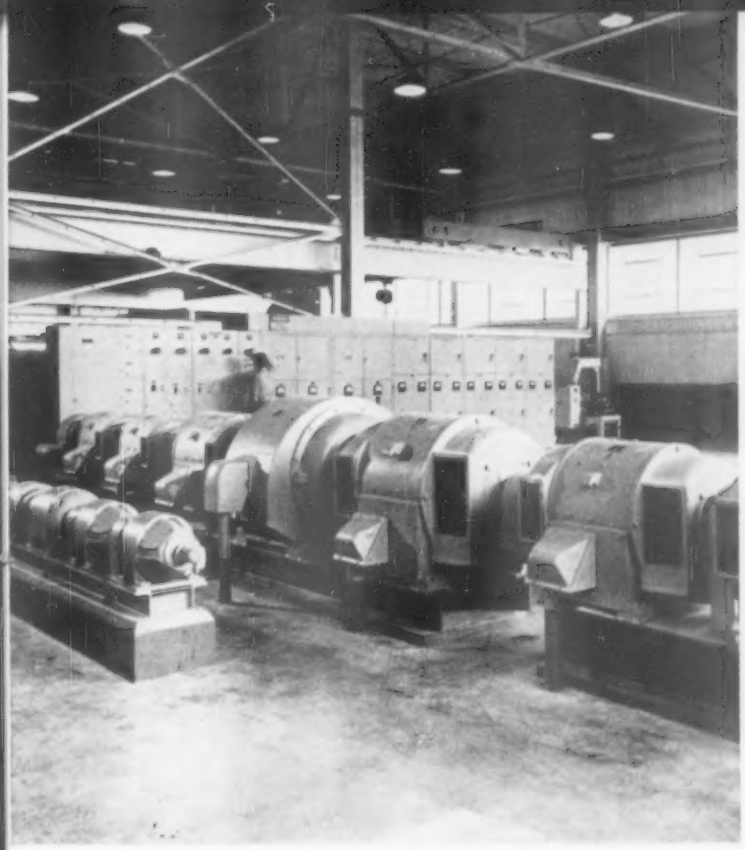
FACTORY ASSEMBLED G-E load center unit substations help cut installation time.

COMPLETE, COMPACT, G-E motor control centers provide centralized control in load areas.

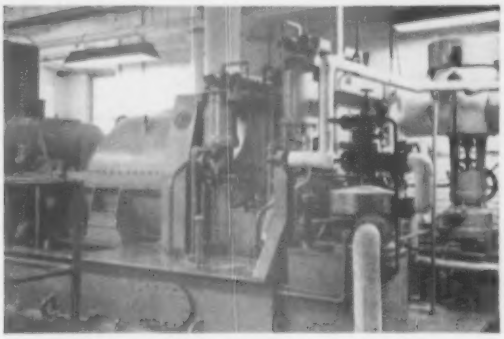
MORE RELIABLE POWER DISTRIBUTION is available with G-E package substations which use co-ordinated transformers, metal-clad switchgear.



SAVE FLOOR SPACE with compact G-E Limit-amp control units.



DEPENDABLE G-E d-c motor generator sets are designed to operate in continuous service at top efficiency. Minimum of maintenance is a key feature of these sturdy generators built for long life.



ECONOMICAL MAINTENANCE is a key feature in design of G-E mechanical drive turbines.

RUGGED CONSTRUCTION of G-E Tri-Clad* motors make them ideal for all types of drive operations. Polyex insulation in motors 100-3000 hp gives 50% longer motor life.

*Reg. Trademark of General Electric Co.

G-E engineering services, equipment can give you . . .

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MODERNIZING, EXPANDING, BUILDING? Whatever your plans, let experienced G-E engineers help plan a more efficient electrical system for you. They will work with you or your engineering contractors to give you correct answers to the following questions.

SHOULD YOU GENERATE OR PURCHASE POWER? G-E engineers will help make a "load" survey of your facilities, and recommend an economical solution to your particular power supply problem.

WHAT TYPE ELECTRICAL DISTRIBUTION SYSTEM SHOULD YOU INSTALL? The latest distribution system concepts will be reviewed with you by G-E engineers. They will help select and design a modern system to meet your individual requirements.

WHAT KIND OF DRIVE EQUIPMENT SHOULD YOU USE? Each application for drives in your processing lines will be individually examined by G-E engineers to assure that the proper drive is designated for the job.

WHERE CAN YOU UTILIZE AUTOMATIC CONTROLS? New developments in the field of automatic controls will be applied throughout your processing lines by G-E engineers.

Let your General Electric Apparatus Sales Representative get you detailed answers to these and other electrical questions. Contact him at your nearest G-E Apparatus Sales Office early in your planning stages. General Electric Company, Schenectady 5, N. Y. 681-5

PROTECT YOUR EQUIPMENT INVESTMENT ▶

Engineered Electrical Systems for Process Industries

GENERAL ELECTRIC

SIX G-E ENGINEERING SERVICES . . .

HELP YOU PROTECT YOUR EQUIPMENT INVESTMENT

1 **G-E APPLICATION ENGINEERING** helps you and your consultants design the right electric system for your plant.

2 **G-E ANALYTICAL ENGINEERING** helps attain the optimum electrical system for your application. Engineering experience backed up by electronic system analyzers save valuable design time.

3 **G-E PRODUCT DEVELOPMENT** laboratories design and test new equipment under tomorrow's conditions to meet your future demands.

4 **G-E FIELD-SERVICE ENGINEERING** helps you supervise installation, expedite start-up of your major electric equipment.

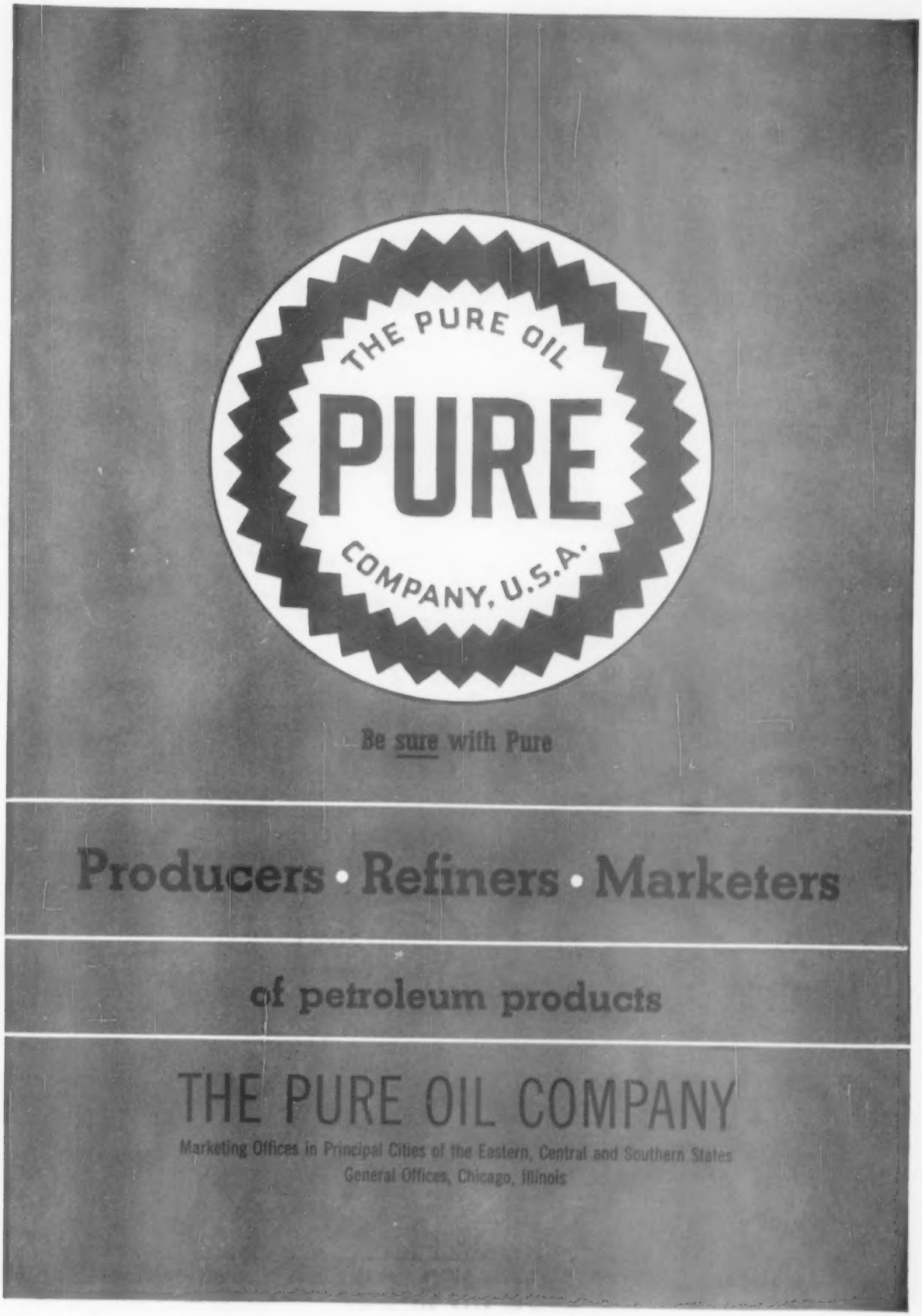
5 **G-E MAINTENANCE SERVICE** from 31 G-E Service Shops will repair and uprate your old equipment, help establish productive maintenance of your equipment, furnish emergency service.

6 **G-E PROJECT CO-ORDINATION** means on-time engineering, shipment, installation of your electric equipment from preliminary diagrams through start-up.

These valuable services are available to you with General Electric equipment. Contact any General Electric Apparatus Sales Office. Meanwhile, for the full story of G-E engineering services, write for brochure GED-2244, General Electric Co., Sect. 681-3, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC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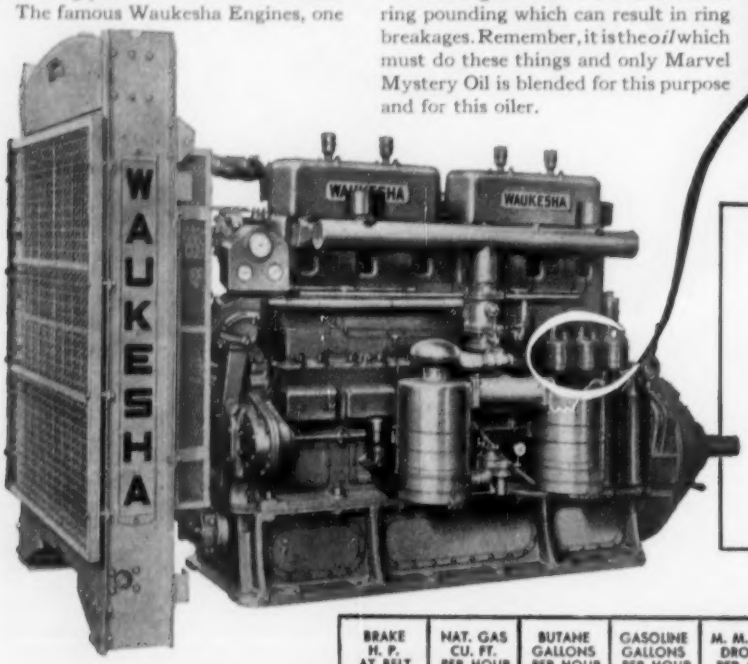
MARVEL INVERSE OILER—
Vital Part of World's Finest Engines

Engine manufacturers think so highly of the Marvel Inverse Oiler they have incorporated it as a vital unit in their engines' lubrication systems.

They have found that engines, equipped with Marvel Inverse Oilers, can be depended upon to give quick acceleration to save trip time . . . keep operating costs to a minimum . . . guarantee hours of continuous performance . . . keep "down-time" low by extending periods between overhauls.

The famous Waukesha Engines, one of which is pictured below, is an example. A truly fine performer, it is equipped with a Marvel Inverse Oiler for Marvel Mystery Oil—finest performing lubricant of all.

The Marvel Inverse Oiler feeds Marvel Mystery Oil in exact proportion to engine speed and load . . . properly lubricating valves and guides, preventing wear and sticking. Keeps upper piston rings free in their grooves . . . retards ring flutter . . . and cushions ring pounding which can result in ring breakages. Remember, it is the *oil* which must do these things and only Marvel Mystery Oil is blended for this purpose and for this oiler.



The Marvel Inverse Oiler

is an integral part of the Waukesha 550 H.P., 1200 RPM gas fuel engine. Operating off the intake manifold, these three completely automatic Oilers feed Marvel Mystery Oil exactly in proportion to engine loads . . . give direct protection to the all-important upper cylinder areas.

BRAKE H. P. AT BELT	NAT. GAS CU. FT. PER HOUR	BUTANE GALLONS PER HOUR	GASOLINE GALLONS PER HOUR	M. M. OIL DROPS PER MIN.	M. M. OIL HOURS PER QUART
10	115.	1.07	1.12	4	228
15	172.5	1.60	1.68	6	152
20	230.	2.14	2.24	8	114
25	287.5	2.67	2.80	10	91
30	345.	3.21	3.36	12	76
35	402.5	3.74	3.92	14	65
40	460.	4.28	4.48	16	57
45	517.5	4.81	5.04	18	50
50	575.	5.35	5.60	20	45
60	690.	6.42	6.72	24	38
70	805.	7.49	7.84	28	32
80	920.	8.56	8.96	32	28
90	1035.	9.63	10.08	36	25
100	1150.	10.70	11.20	40	22
120	1380.	12.84	13.44	48	19
140	1610.	14.98	15.68	56	17
160	1840.	17.12	17.92	64	14
180	2070.	19.26	20.16	72	12
200	2300.	21.40	22.40	80	11
225	2587.5	24.00	25.20	90	10
250	2875.	26.75	28.00	100	9
275	3162.5	29.42	31.10	110	8
300	3450.	32.10	33.60	120	7

This Chart shows the proper setting for constant load engines ▶

◀ ***Chart shows total oil consumption***

EXAMPLE:—If you use 805 cu. ft. of dry gas, 7.49 gallons of butane or 7.84 gallons of gasoline, your H.P. is about 70, so adjust oiler to feed 28 drops per minute. You will then receive about 32 hours per quart of MARVEL MYSTERY OIL.

If engine load increases after setting for normal load, oiler will automatically increase its feed, decreasing when load is lessened.

To determine drop count per oiler when more than one is used on an engine—divide recommended drop count by number of oilers.

NOTE: Guarantee on oiler is void if any other oil than MARVEL MYSTERY OIL is used. Some *engines* also carry this guarantee policy.

See Your Local Jobber or Oil Well Supply House

EMEROL MFG. CO. *Dept. 370, 242 West 69th Street New York 23, N. Y.*

"those people at the **REPUBLIC** sure do know OIL Financing . . ."

We're proud of comments like this — for they underscore this fact: From Texas to the Williston Basin, from South America to the Middle East to Canada . . . Oil men know the Republic as one of the world's leading banks in Oil Production Loans.

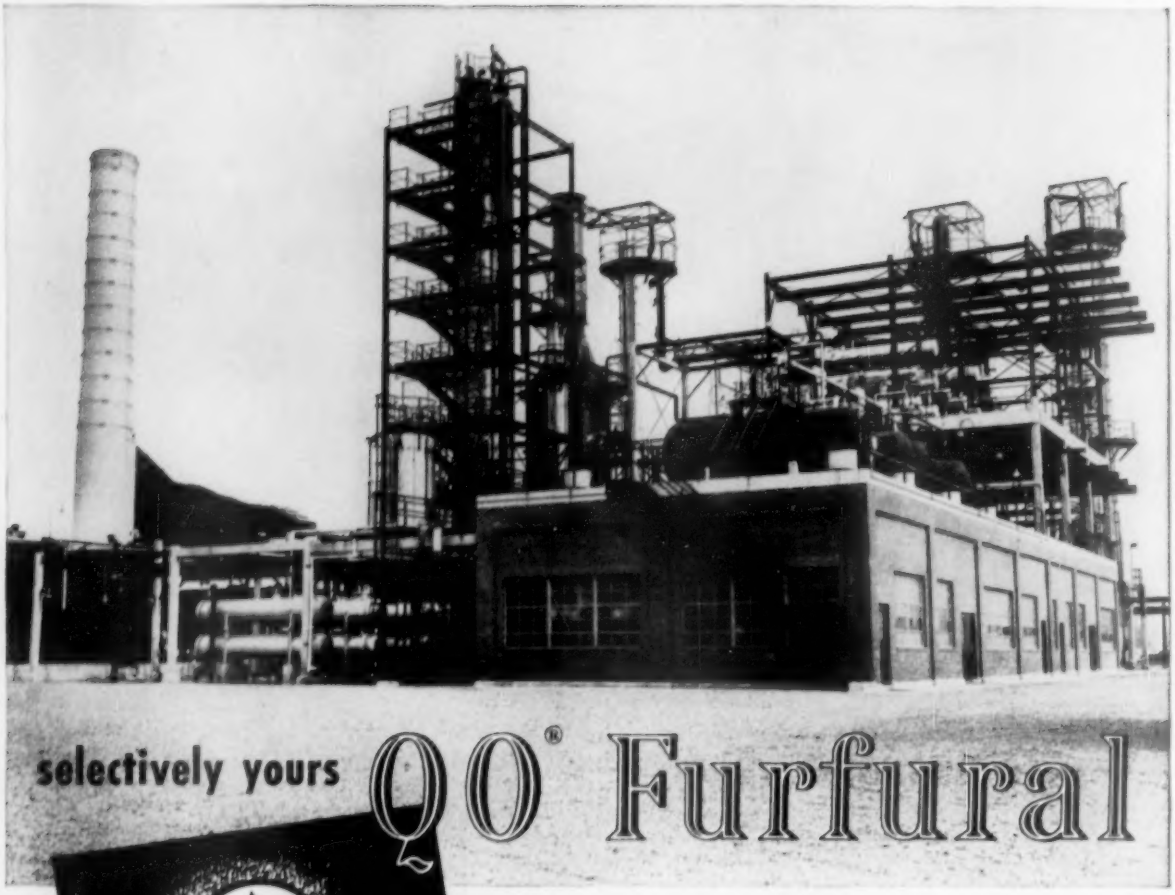
We'd like to serve you, too!

The Financial Center of the Southwest

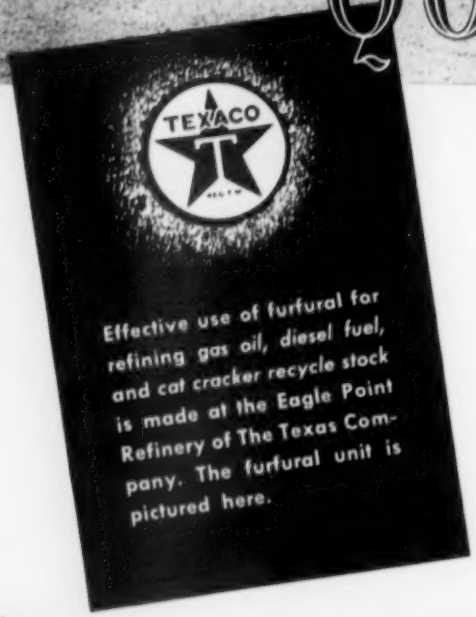
REPUBLIC
NATIONAL BANK of Dallas

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

CAPITAL AND SURPLUS $60,000,000
LARGEST IN THE SOUTH



selectively yours QO® Furfural


TEXACO
Effective use of furfural for refining gas oil, diesel fuel, and cat cracker recycle stock is made at the Eagle Point Refinery of The Texas Company. The furfural unit is pictured here.

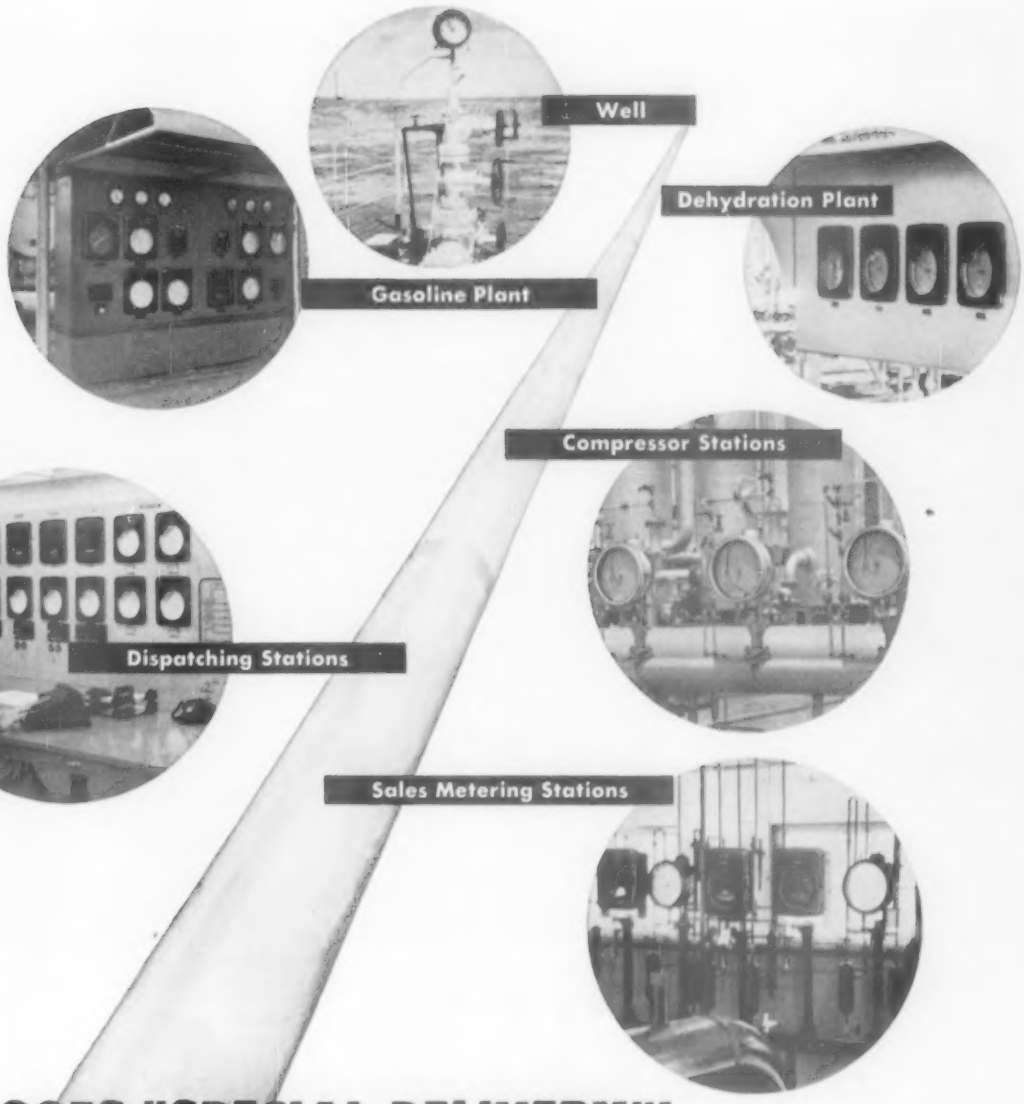
Through the years QO furfural has gained widespread recognition as a selective solvent in the processing of lube oil, and now there is a growing awareness of its desirable characteristics as a solvent in performing other separations in the refinery. Better furnace oils, improved diesel fuel, and a new approach to increasing gasoline output of catalytic crackers at minimum expense are the direct results.

The same combination of basic properties and attractive economics which have made QO furfural so successful in refining lube oil applies with equal force to these newer applications. These basic values include: sharp selectivity, ease of recovery, low cost, ready availability, and freedom from excessive toxicity.

The furfural processes are available for licensing and we are glad to refer you to the licensor, as well as to supply additional information about QO furfural itself. Write for bulletin 203.

QO The Quaker Oats Company CHEMICALS DEPT.

339V The Merchandise Mart, Chicago 54, Illinois
Room 539V, 120 Wall St., New York 5, N. Y.
Room 439V, P. O. Box 4376, Portland 8, Oregon
In the United Kingdom: Imperial Chemical Industries Ltd., Billingham, England
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France
In Australia: Swift & Company, Pty., Ltd., Sydney • In Japan: F. Kanematsu & Company Ltd., Tokyo



GAS GOES "SPECIAL DELIVERY"!

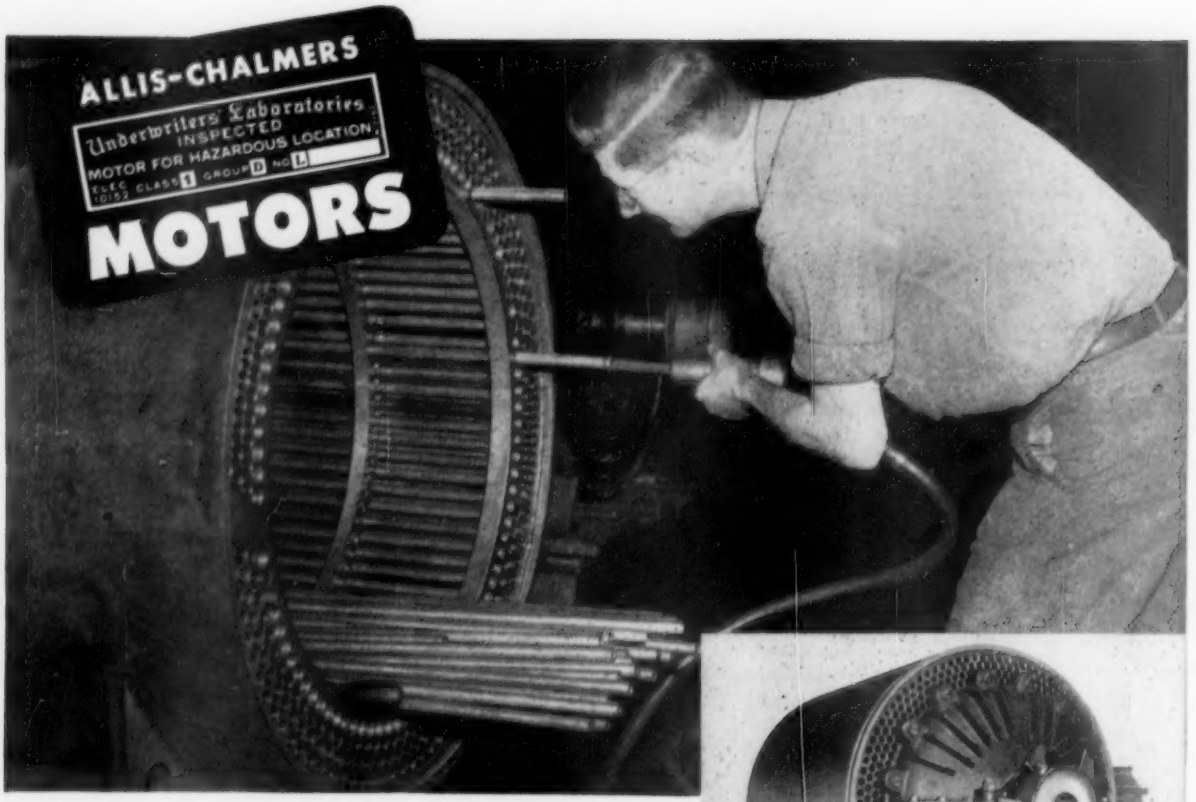
. . . under Foxboro Control

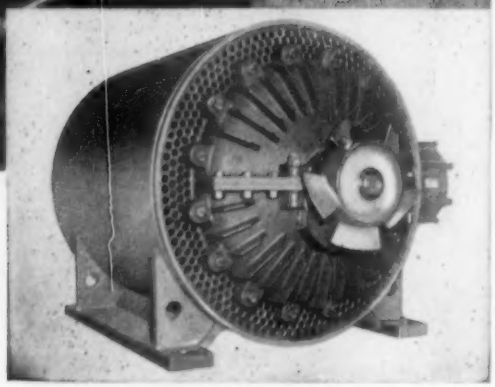
From well to city gate, natural gas flows more efficiently, with less supervision, in Foxboro-instrumented pipelines. At every stage — production — processing — transmission — delivery — Foxboro Instruments measure and automatically control gas movement and related operating variables. The resulting highly integrated control system keeps loads perfectly balanced . . . vital equipment constantly protected. For information on the latest methods of pipeline control, contact your nearby Foxboro Sales Engineer, or write The Foxboro Company, 606 Neponset Ave., Foxboro, Mass., U.S.A.

FOXBORO
Reg. U. S. Pat. Off.

Instrumentation for Pipelines

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND





3600-rpm explosion-proof motor with fan housing removed to show unidirectional fan.

These heat exchanger tubes

Protect this motor from dirt and corrosion

COOLING AIR is carried through the heat exchanger tubes with sufficient velocity to expel practically all kinds of dirt. If oily or sticky dirt should cling, tubes can be ramrodded clean on the spot in a few minutes because tubes are straight and tube ends are exposed. Also, the tubes are distributed uniformly around the perimeter of the stator yoke and along its full length — cooling all parts of the motor evenly.

Choice of Corrosion-resistant Materials

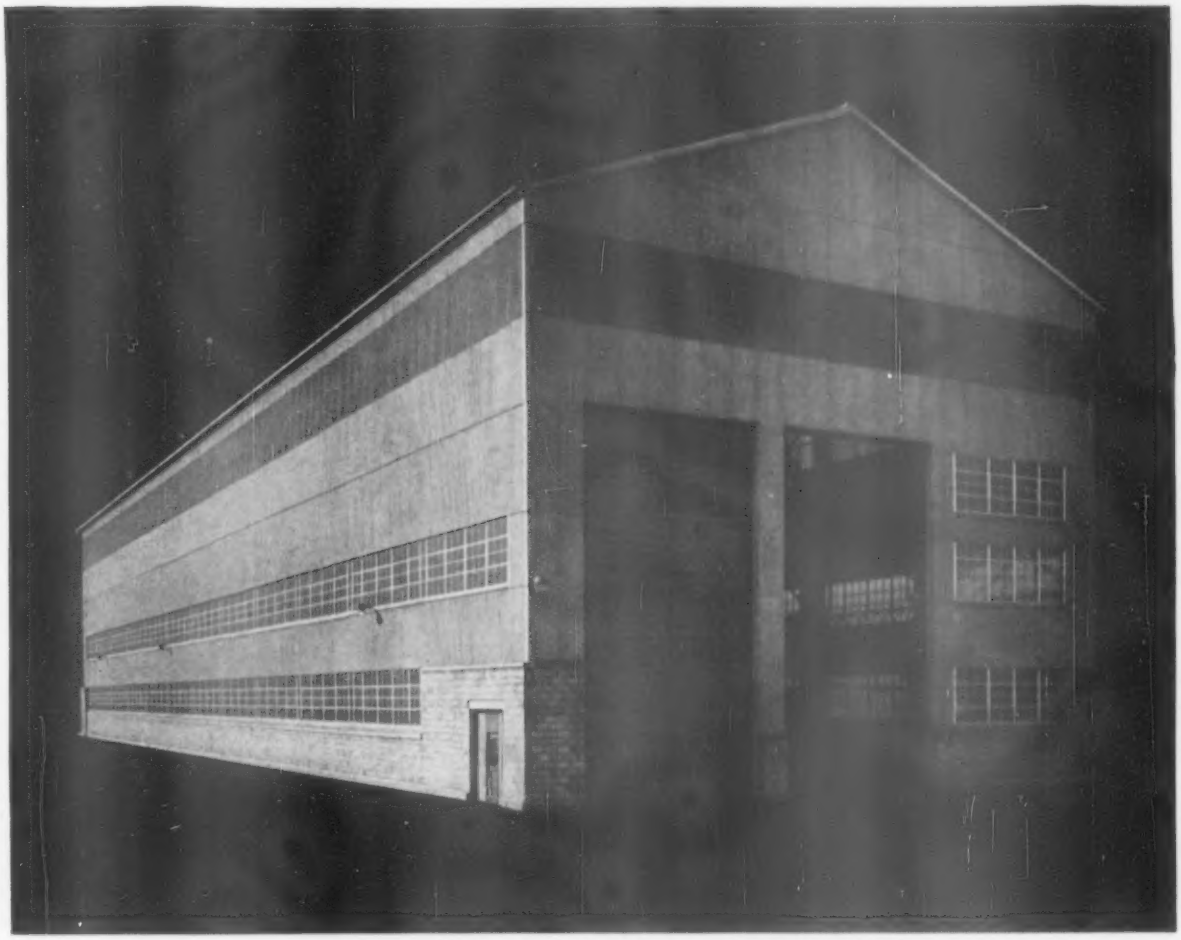
You can lick corrosion with this motor, too. Tubes are available in a variety of materials to meet practically any corrosive atmospheric condition. Allis-Chalmers tube-type motors have long and successful experience in such difficult applications as caustic plants, refineries and petrochemical plants, power plants with fly ash problems and many others.

Get Complete Information

Next time you need a motor for a dirty or corrosive location or for outdoor operation in all kinds of weather, call your Allis-Chalmers District Office. Get complete information on Allis-Chalmers tube-type totally-enclosed, fan-cooled and explosion-proof motors. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7149. Available in ratings on frames larger than NEMA 505 up to 3000 hp (labelled through 1250 hp, 1800 rpm).

A-4558

ALLIS-CHALMERS



Years of service. Long, trouble-free life is assured by K&M Corrugated Asbestos Sheets. They are used on the roof and sides of this building at the Osgood Company, Marion, Ohio. Application Contractor: Elwin G. Smith Co., Toledo, Ohio.

CUT MAINTENANCE COSTS

with K&M Corrugated Asbestos Roofing and Siding

When K&M Corrugated Asbestos Sheets go up, upkeep expenses stay down. They never need protective painting, require little or no maintenance.

Really rugged. These sheets are strong, dense, and tough. Made of asbestos fiber and portland cement, they won't burn, rot, or corrode. And they're highly resistant to extremes in weather.

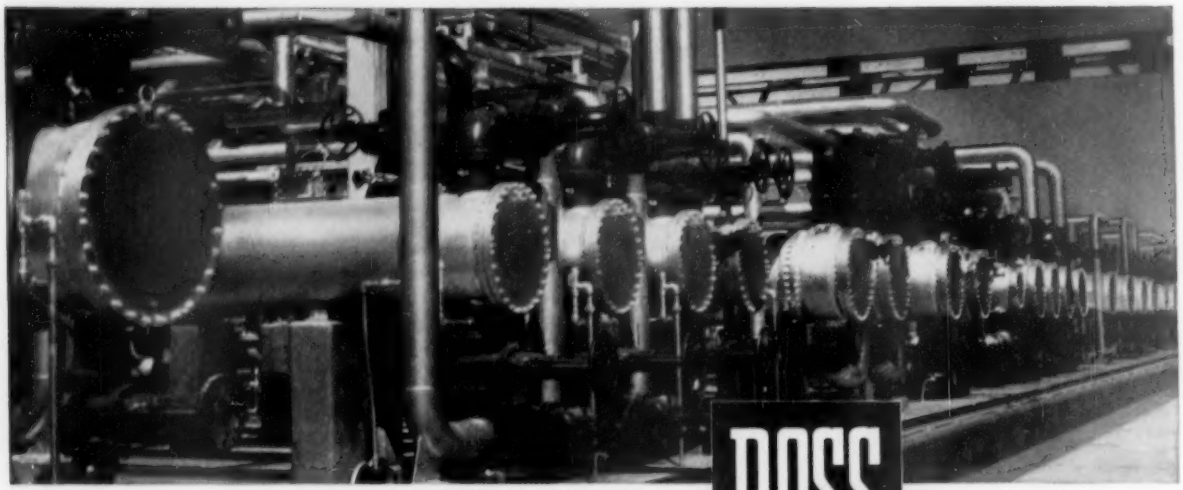
Big savings. These corrugated sheets make possible low application costs—they need only a minimum of cutting or fitting. And they offer the extra money-saving feature of needing little or no upkeep.

Send for details. At your request, we'll gladly send complete data on K&M Corrugated Asbestos-Cement Sheets. Write today.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos

HEAT EXCHANGERS BY THE MILE



If you watch production at the Kewanee-Ross plants, you'll see the world's most modern heat exchanger assembly techniques at work . . . moving exchangers and condensers down the lines by the thousands . . . to serve industries here and abroad.

Complex, highly specialized refinery exchangers and giant power plant surface condensers . . . one of a kind or dozens alike. Completely standardized engine oil and water coolers, compressor inter and after coolers, hydraulic fluid coolers . . . hundreds upon hundreds of identical units. End-to-end, they would stretch out for miles.

Standardized or specialized, mammoth or pocket size, single or by the thousand . . . whatever industries require in heat exchangers, Kewanee-Ross makes it. In its long, diversified experience, this Company has engineered and built virtually everything that is sound and practical in heat transfer equipment.

Where can you find a more qualified source for serving *your* requirements? Who could possibly be in a better position to work with you . . . to recommend and *deliver* exactly what you need? Your request will bring a Kewanee-Ross engineer promptly to your desk. Write.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1417 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

MEMBER TEMA

Serving home and industry: AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

G.E. DEVELOPS NEW PLUG-IN CHASSIS FOR 2-WAY RADIO

NEW PROGRESS LINE saves money on maintenance through faster servicing—protects from obsolescence because chassis are quickly interchangeable.

IN the new Progress Line, transmitter, receiver, power supply and optional chassis are individually rack-mounted in a triple-rigid mobile case. Rapid interchangeability is provided by this rack construction and true plug-in chassis. This plug-in design permits changes in frequency, power, type of reception (narrow or wide band) quickly *at minimum cost, at any time.* You're free of any obsolescence risk!

You may switch Progress Line mobile units—whether front or trunk mount, between vehicles with 6 or 12 volt DC systems. No electrical alterations are needed. And any mobile combination can be converted quickly to a low-cost, 117 volt AC intermittent duty base station by changing only the power supply chassis!

Let a G-E Communications Counselor analyze your radio needs and develop an installation or conversion program planned for long-run savings. Write or call today for full specifications on the new PROGRESS LINE. *General Electric Company, Communication Equipment, Section X855-2. Electronics Park, Syracuse, N.Y.*

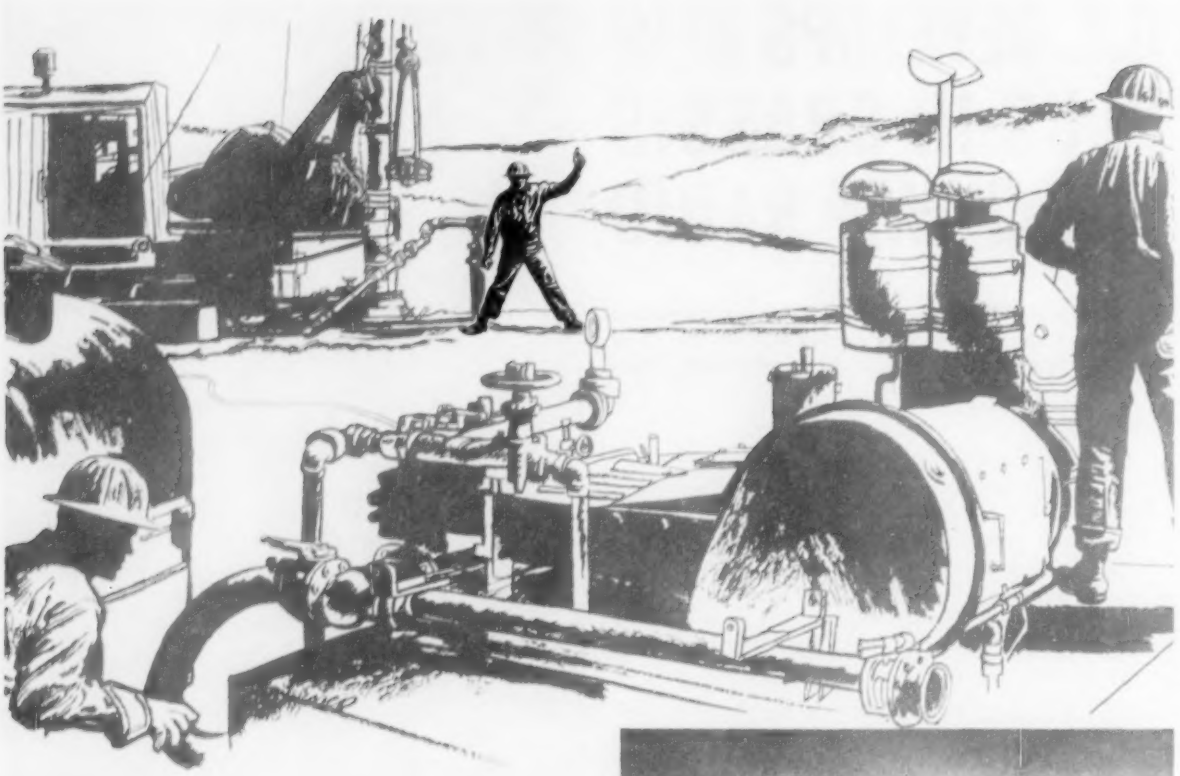
INDIVIDUAL PLUG-IN CHASSIS minimize capital investment in spares and reduce radio maintenance time! Your vehicles will be back "in service" faster. For instance, you can replace either a transmitter or receiver plug-in chassis right in the vehicle in 5 minutes—using only a screwdriver. Individual plug-in chassis of the new General Electric Progress Line units also provide complete interchangeability between mobile and station transmitters and receivers.

◀ There is a G-E Authorized Service Station near you. Look for this sign.

EASY FRONT MOUNTING under the dash. The new G-E Progress Line case is less than 15" deep. For the first time you can have a 90-watt front mount mobile unit in the 25-54 MC band and a 50-watt front mount mobile unit in the 144-174 MC band. In the 25-54 MC band you can now have simultaneous monitoring of 2 channels, in the same case, without additional equipment.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Transmits engine power

Smooth as Steam

gets production where others fail

Caddo Chemical Company of Wichita Falls, Texas, reports that its TORQMATIC-equipped unit fractures wells about 75% faster, succeeds in bringing back wells where other units failed.

And Superintendent John Smith says the switch from mechanical drive to his Allison TORQMATIC DRIVE permits him to fracture 6000-foot wells where he was limited to wells 2000 feet deep.

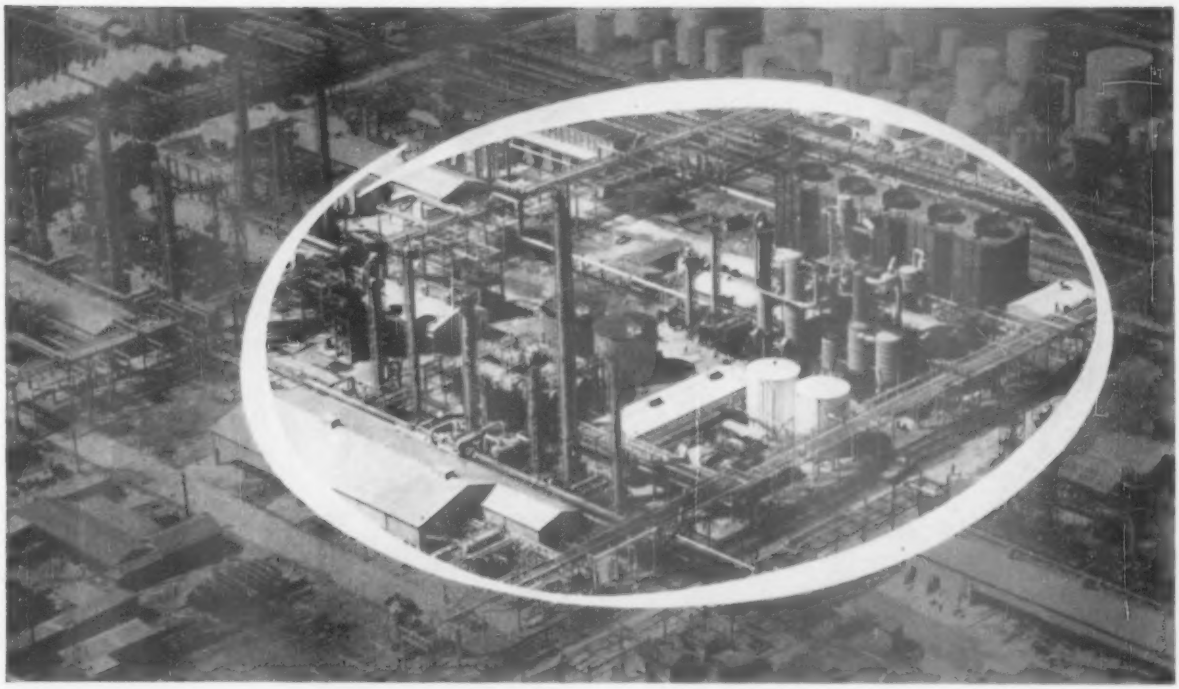
The TORQMATIC-equipped unit costs about 10 to 15% less to operate, cuts maintenance costs, eliminates the need for an extra truck. It pumps 9 barrels of sand-oil mix per minute compared to 3½ barrels for mechanical-drive units. It gets mix pressure up to 5500 psi. in high gear, transmitting power from a GM Diesel to a Western Triplex pump.

Allison's TORQMATIC Converter-Transmission team transmits engine power *smooth as steam*. It delivers more mix at higher pressure to well-bottom sand formations. And it quick-shifts at full throttle—eliminates the danger of sand-oil mix settling in the wells when operators cut power to shift gears.

Owners and operators of drilling rigs, servicing units and fracturing units report Allison TORQMATIC Converters and Transmissions speed operations and cut maintenance costs from spud-in to well-bottom. Ask your engine distributor, equipment manufacturer or dealer about TORQMATIC DRIVES next time you buy. Or get full details from Allison Division of General Motors, Box 894R, Indianapolis 6, Indiana.

GM TORQMATIC *Allison*

TORQMATIC DRIVES



In this circle purity is an absolute must

...so is Nickel— and here's why

You are looking at a section of Shell Chemical Corporation's Deer Park, Texas, plant.

There, Shell synthesizes glycerine from propylene, with allyl chloride as an intermediate. There, too, the glycerine is evaporated, purified of salt, steam-stripped, distilled and stored.

All this means corrosion and purity problems. Chlorine and propylene are reacted at a temperature which greatly accelerates corrosive attack . . . salt is present in the crude product . . . and there are strict limits on the heavy metals content of glycerine.

Yet Shell successfully combats corrosion to turn out a colorless, odorless product that assays better than 99% glycerol and meets all the usual specification requirements.

How does Shell do it?

With Inconel: in mixing jets for reacting propylene and chlorine at about 950°F. Inconel combines resistance to both heat and corrosion.

With Nickel-Clad Steel; in evaporators, distillation columns, storage tanks . . . wherever glycerine is concentrated. Nickel-Clad Steel combines the protection of Nickel with the economy of steel.

With Monel; in continuous centrifugal filter equipment used to remove sodium chloride by-product. Monel gives high corrosion-resistance and high strength in a single metal.

With pure Nickel; in bubble caps and trays; reboiler and condenser tubes, pumps, and piping. Nickel keeps metal pick-up at a minimum in hard-to-maintain areas.

The correct application of Nickel and Nickel alloys in the production or handling of glycerine can do much to lower costs and improve the quality of the product. Inco's Corrosion Engineering Section will be glad to work with you in solving specific problems connected with purity or corrosion in your own plant. Just write:

THE INTERNATIONAL NICKEL CO., INC.
67 Wall Street **New York 5, N. Y.**

Inco Nickel Alloys

Monel® • "R"® Monel • "K"® Monel • "KR"® Monel
"S"® Monel • Inconel® • Inconel "X"®
Inconel "W"® • Incoloy® • Nimonic® Alloys
Nickel • Low Carbon Nickel • Duranickel®

AND NOW—

Copon

in TRANSCO'S "SUPER INCH"

Long sections of Transcontinental's new 36-inch loop are coated with Copon Internal Pipe Coating for efficient delivery of cleaner gas

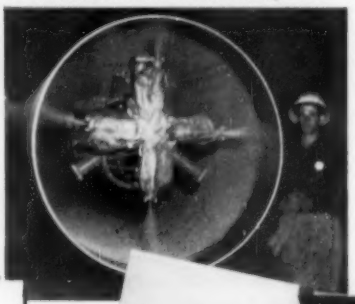
Here are the simple, factual reasons why more and more transmission lines are using COPON:

1. Proven protection against corrosion.
2. Complete internal protection of pipe during stockpiling, transportation and laying of line.
3. Reduced cost of using scrubbers and strainers.
4. Cleaner gas delivery greatly reduces maintenance and labor costs.
5. Over the years COPON saves many times its cost.

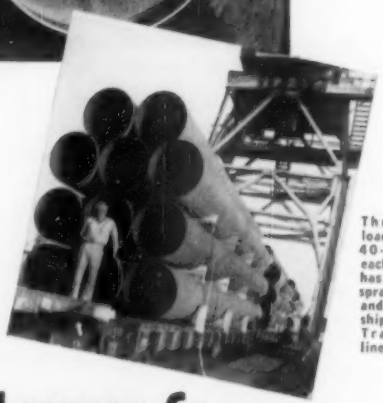
Our technicians can give your corrosion engineers, and others in your company responsible for obtaining most efficient operation, detailed evidence of Copon's exclusive characteristics.

This Coupon is for Your Convenience in Getting More Copon Facts Pronto!

Rows of 36" pipe, destined for Transco's "Super Inch" line, as it is rolled from Consolidated Western Steel Company's Orange plant to Rossen-Richards' yard where it will be chemically cleaned and sprayed internally with Copon, the effective corrosion control coating.



Close-up showing how pipe is pressure-sprayed with Copon at Rossen-Richards yard in Orange, Texas. Pipe is rotated as automatic sprayheads are slowly pulled through entire 40-foot length of pipe.



Three flat cars loaded with eleven 40-foot joints each. This pipe has been Copon-sprayed internally and is ready for shipment to the Transcontinental line.

COAST PAINT & LACQUER CO., INC.
P. O. Box 1113, Houston 1, Texas

Please send me information about COPON Internal Pipe Coating.

Name_____

Company_____

Position or Title_____

Address_____

City_____ State_____

COAST Paint & Lacquer Co. Inc.

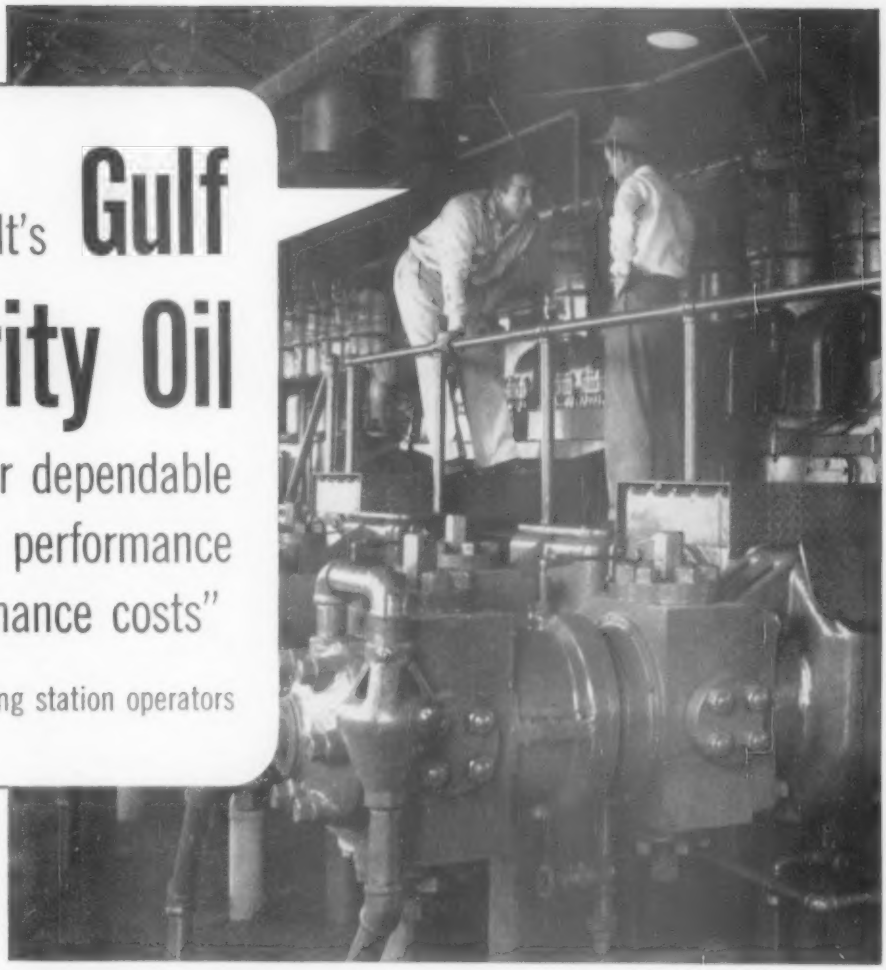
P. O. BOX 1113, HOUSTON 1, TEXAS

"It's **Gulf**

Security Oil

for dependable
gas compressor performance
and low maintenance costs"

say pumping station operators



Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

Gulf Oil Corporation • Gulf Refining Company
1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF

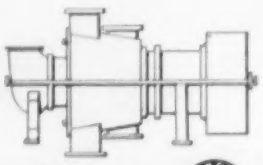
The finest petroleum products for your every need

FACTS on Westinghouse 5000-hp gas turbines . . .

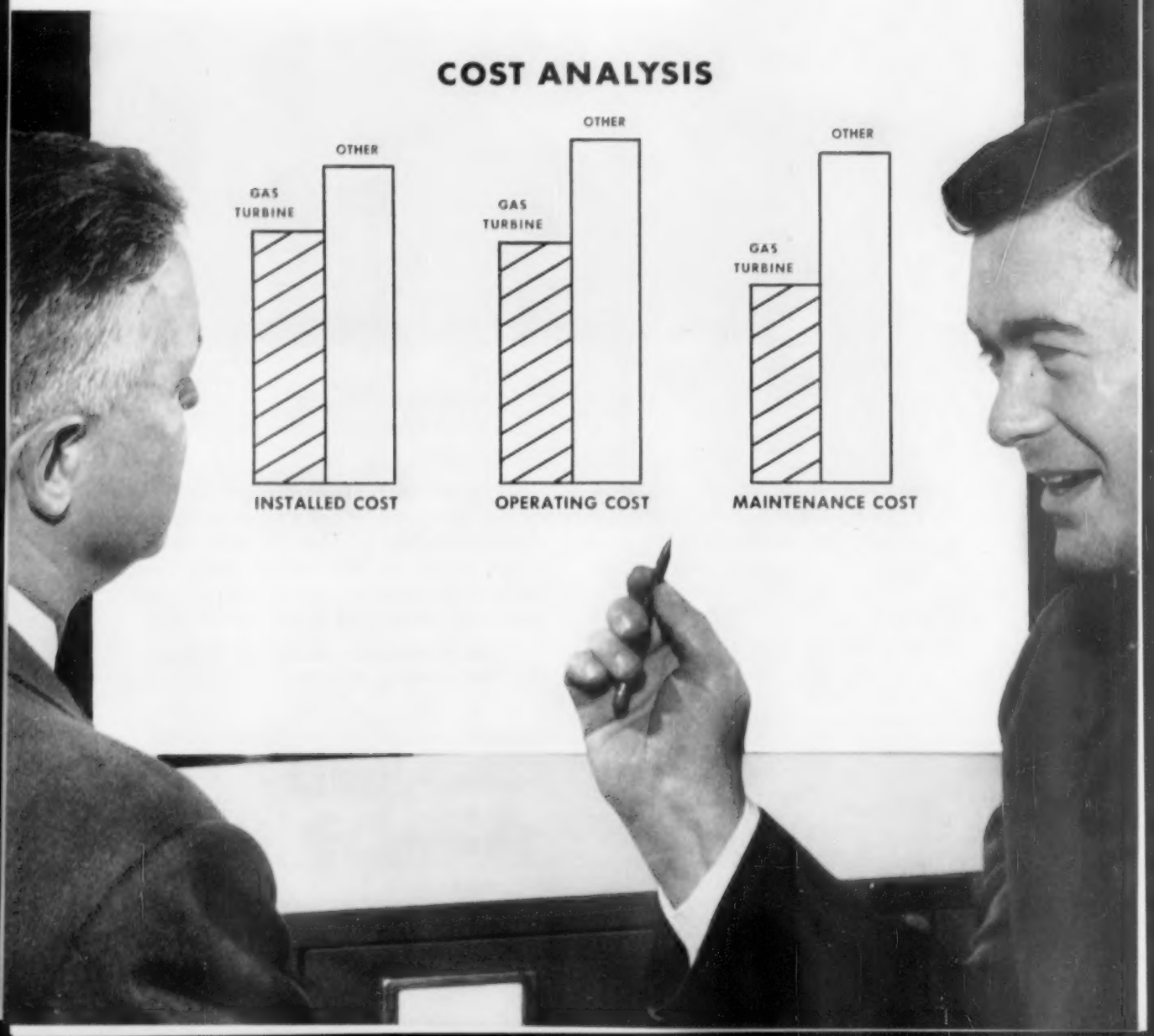
Lowest cost per booster horsepower

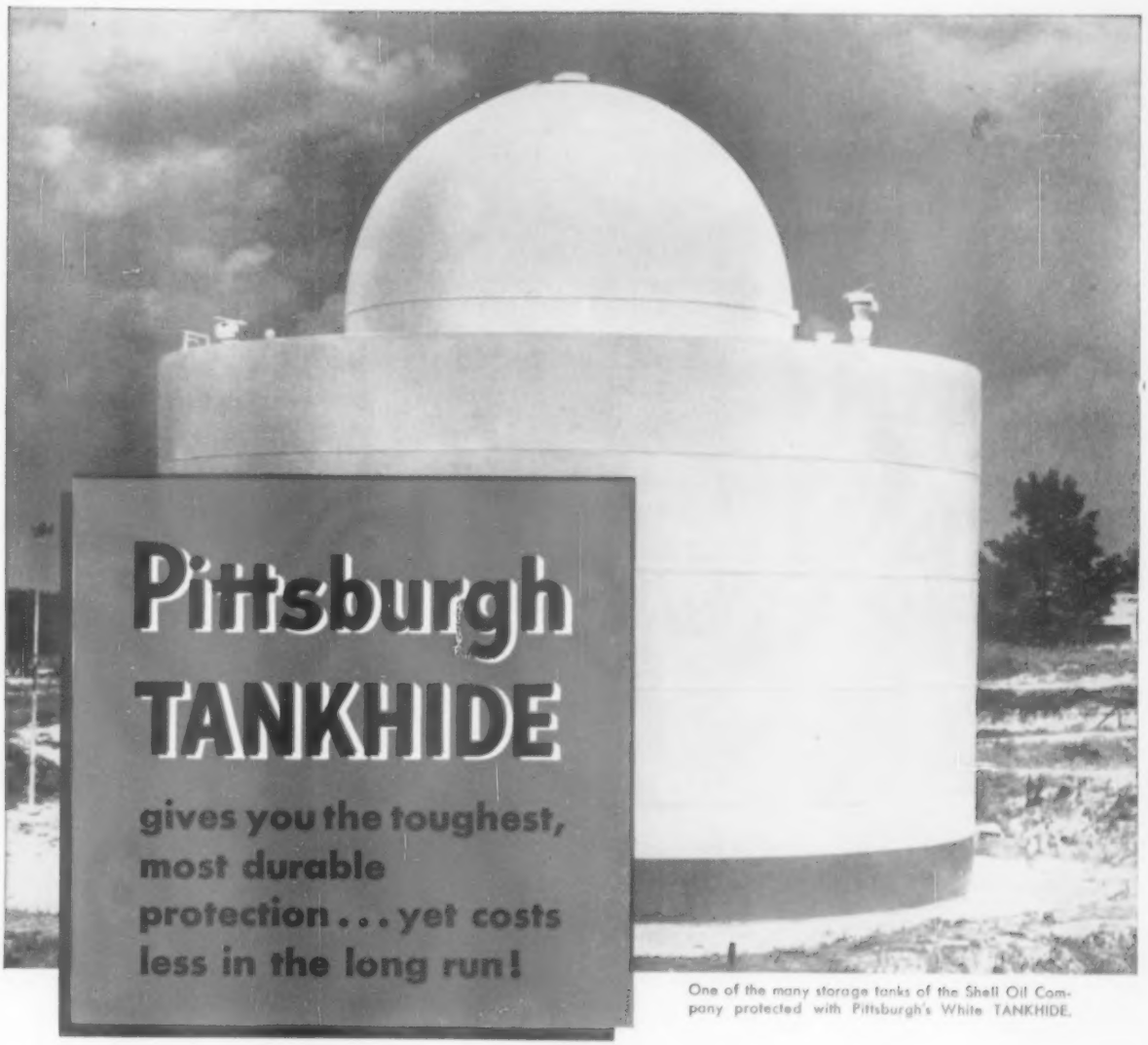
Here's why: Lowest first cost. • Takes fewer horsepower to do the job. • Lighter and smaller foundation required. • Much lower lube oil consumption. • No gas-cooling equipment required. • No water needed. • Lower maintenance. • Operation guaranteed to meet all specifications.

For more information, see your Westinghouse sales engineer, THE MAN WITH THE FACTS, or write for booklet B-5859. Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa. J-50579



YOU CAN BE SURE...IF IT'S Westinghouse





One of the many storage tanks of the Shell Oil Company protected with Pittsburgh's White TANKHIDE.

IF IT'S TOUGHNESS, durability and low-cost protection you want for oil and gasoline storage tanks—Pittsburgh's TANKHIDE gives you what you're looking for.

Nothing is left to guesswork to make TANKHIDE a rugged and enduring finish highly resistant to the destructive effects of weather and corrosion. The materials that go into it—pigments, oils, resins, solvents and thinners—are all subjected to careful tests to make sure they measure up to rigid quality requirements. A series of constant and meticulous checks at every step in its making assure easy application, thorough hiding, quick drying, uniform texture and long life.

TANKHIDE primers and finishing coats have been used satisfactorily for many years to protect millions of tons of iron and steel in structures, equipment and machinery in all sections of the country.

Besides TANKHIDE, Pittsburgh offers a complete line of high-quality protective coatings for every other need in the petroleum industry. These include production and refinery finishes for towers, pipe lines, buildings and equipment; service and bulk station paints; pump enamels and drum finishes.

Call on us for advisory service. Our wide experience can often help you and save you both time and money.

Send for FREE Paint Manual!

● Here's a handy manual of paint information that contains complete descriptions of all Pittsburgh finishes for the petroleum industry. Also tells how to use them most advantageously. We'll be glad to send you a copy—FREE. Just mail this coupon.

Pittsburgh Plate Glass Company,
632 Duquesne Way,
Pittsburgh, Pa.

Please mail me a free copy of your comprehensive reference manual, "Pittsburgh Paints for the Petroleum Industry."

Name_____

Street_____

City_____ State_____

PITTSBURGH PLATE GLASS CO. Factories: Milwaukee, Wis.; Newark, N.J.; Springdale, Pa.; Atlanta, Ga.; Houston, Texas; Torrance, Calif.; Portland, Ore. Ditzler Color Div., Detroit, Michigan. Thresher Paint & Varnish Division, Dayton, Ohio. Forbes Finishes Division, Cleveland, Ohio. M. B. Suydam Div., Pittsburgh, Pa.

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

LP Gas . . . and Beacon Petroleum Company

It wasn't too long ago that gas was flared at the well site. Today this gas has become an important source of revenue for oil producers. With an experienced and aggressive staff, Beacon Petroleum offers producers a service they find impossible to duplicate.

If you have any petroleum products to sell, contact Beacon . . . or if you want to buy petroleum products contact Beacon . . . we have the facilities and know-how to fulfill your every need.

BEACONGAS

BEACON

PETROLEUM COMPANY

TULSA • HOUSTON

MARKETERS OF NATURAL GASOLINE, BUTANE-PROPANE, MOTOR FUEL, FUEL OILS

UNIVERSITY LANDS

Oil and Gas Leases

TO BE OFFERED BY

THE BOARD FOR LEASE
OF
THE UNIVERSITY OF TEXAS
LANDS

AT

THIRTY-FIFTH PUBLIC AUCTION

TUESDAY, JUNE 28, 1955

COMMENCING AT 10:00 A.M. AT THE
COMMODORE PERRY HOTEL
AUSTIN, TEXAS

List of leases and additional information obtainable from:

Board for Lease of University Lands
P. O. Box 7986—University Station
Austin, Texas

or

University Lands—Geology
P. O. Box 1663
Midland, Texas

They Say—

"Tidings on the Tidelands"
Reprinted from the Times-Picayune
New Orleans States

An Oil-Country Lawyer Speaks

"As an oil-country lawyer, I say . . . that the thought of trying to operate in our industry under the myriad rules, regulations, and interpretations which are fundamentally a part of federal control chills the heart and kills the incentive of all independent producers . . .

"We in our industry know that progress has been made under free economic competitive conditions. As a high-risk industry, it can continue to operate successfully only upon an incentive basis. If incentive is removed, and if this industry, or any segment thereof, is to be regulated as a public utility, we see but one result—that of federal control of all segments of the industry from production to the final marketing of its many and varied products—and then nationalization of the entire industry . . ."

Clarence T. Smith, Flora, Ill., independent producer and a director of the Illinois Oil and Gas Association, in testimony prepared for the State interstate and foreign commerce committee.

Texaco Looks Ahead

"Long-range forecasts recently have been made by my company's economic department.

"For the 5-year period, 1955 through 1959, we look forward to substantial gains. We estimate that total domestic demand in 1955 will increase 5 per cent over 1954, compared with a 1.9 per cent gain last year. For the 5-year period, total domestic demand should

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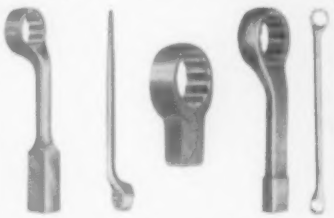

From the big PROTO line you can choose the extra-strong industrial wrenches you need for almost any job. All are forged from special alloy steels for strength, and have superior design features that make them your best buy!

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Finding a World of Oil for a Quarter-Century

reflect an increase of about 22.6 per cent.

"By products, our 5-year estimates call for these increases in demand: gasoline, 18 per cent; distillates, 33 per cent; residual, 13 per cent.

"Translating all of these figures and statistics into sales dollars, I don't see how many of us can help but agree that the years ahead of us are filled with opportunity . . ."

S. C. Bartlett, vice president in charge of domestic sales department, The Texas Co., in an address before the Empire State Petroleum Association.

Controls Mean Gas Scarcity

"It is my belief that restrictive federal controls on production (of natural gas) will so retard exploration and development as to create a scarcity of natural gas, and therefore increase prices of natural gas even under federal regulation.

"It is my firm belief that exploration and discovery, which is the life blood of gas service, cannot flourish under any system other than one of free competitive enterprise."

Glenn W. Clark, Oklahoma City, president of Cities Service Gas Co., in an address before the Kansas City Chamber of Commerce.

Tulsa Says "No"

"Claims have been made that northeastern area gas consumers have been faced with 'continuous' gas-rate increases . . . By contrast, I would point out that in Tulsa there have been only five natural-gas consumer rate adjustments since 1923, and three of these have been downward.

"It is . . . obvious that if consumers of other areas have been 'harassed' by rate increases, the nominal producer price is not the cause. Tulsa is served from the same producing areas as many northeastern municipalities. Our advantage is being close to supply. I question whether mere men, sitting in Washington, could juggle the natural-economic laws so as to remove the disparity in price in all sections of our country.

"I can only conclude that if natural-gas rates are unreasonable in Philadelphia or New York or Boston, the cause lies in the cost of transportation and distribution . . . By any accepted standard, natural gas produced in the Southwest, at the well, is today the cheapest fuel at the source of production—on a heat-value basis—in the entire world.

"I am profoundly disturbed by the growing misunderstanding of facts which to me seem obvious in this matter. I feel that someone in the business of promoting centralized bureaucracy

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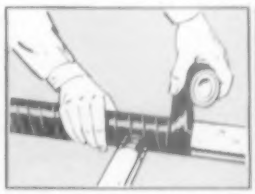

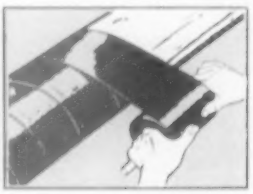

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in our beloved country must be working overtime to have planted so many seeds of mistrust against a basic American industry . . .

"To give small, individual natural-gas producers the status of federal public utilities would be setting a dangerous precedent in America. If we do this in 1955—in 1956 it will be oil, then coal, then lumber, and cattle, and wheat. To lay the withering hand of federal control on local commodity production is the first step toward state socialism . . ."

Mayor L. C. Clark of Tulsa in a letter to Mayor Joseph S. Clark, Jr., of Philadelphia in declining to join the "mayors' committee" working for federal regulation of natural-gas producers.

Creole and Imports

"The oil import restriction issue . . . has been a center of attention in the current public and congressional debate designed to shape the future foreign-trade policy of the United States. This is as it should be since oil is the most important single item of world trade.

"It is becoming increasingly clear that the economic well-being of the United States and her allies is a cornerstone required for the establishment of military and political security in the free world. We believe that expanding world trade is a necessity to the achievement of such security.

"The U. S. is not only becoming increasingly dependent on strategic materials from outside her borders, but, more importantly, it is clear that the standard of living of the U. S. cannot continue to rise indefinitely without her having access to the world's natural resources and to export markets. It is equally clear that U. S. leadership in the field of foreign trade is a necessity. We have to prove by our actions that we believe in capitalistic competition, both within our economy and in competition with others. The actual benefits which are now received by the U. S. through foreign trade are evident . . .

"The U. S. Senate has approved a 3-year extension of the Reciprocal Trade Agreements Act with an amendment empowering the President to curb imports whenever he finds an industry is being damaged in a way that imperils national security . . . We feel that such action on the part of Congress will be a good move in the long-range interest of a sound American foreign policy. Insofar as we are concerned, we shall continue to do all that we can to conform with the spirit of the recommendation of the Cabinet Committee of Energy Supplies and Resources Policy . . ."

H. W. Haight, president, Creole Petroleum Corp., in an address at the annual stockholders meeting.

One Industry in Making

"It seems to me very likely that as time goes on the chemical business and the petroleum business will gradually merge and be almost indistinguishable.

"We will be forced more and more to break up crude oil into small building blocks and reassemble these to form the particular kind of molecules we want . . ."

Chester F. Smith, vice president and director of Standard Oil Co. (N.J.), in an address in St. Louis before the American Petroleum Institute Division of Refining meeting.

We Haven't Reached That Point

"We have not reached the point in this country where we are going to permit a federal agency to control the prices of a commodity produced in a competitive market.

"The present order (the Phillips case decision) is confiscation; it is socialistic. It is absolutely foreign to every concept of a free government. . . ."

Sen. Lyndon Johnson of Texas in a statement issued in Washington.

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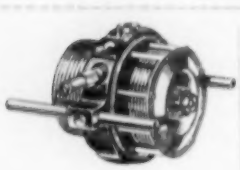
For further information please request Bulletin 11c-4 or contact Barton sales representatives in most principal cities.



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Butler bolted steel tanks are made of die-formed, precision-punched sheets that go up fast, require little maintenance, stay in excellent condition for years. Choice of two-coat aluminum painted or hot-dip galvanized finish. Capacities 100 to 10,000 barrels.

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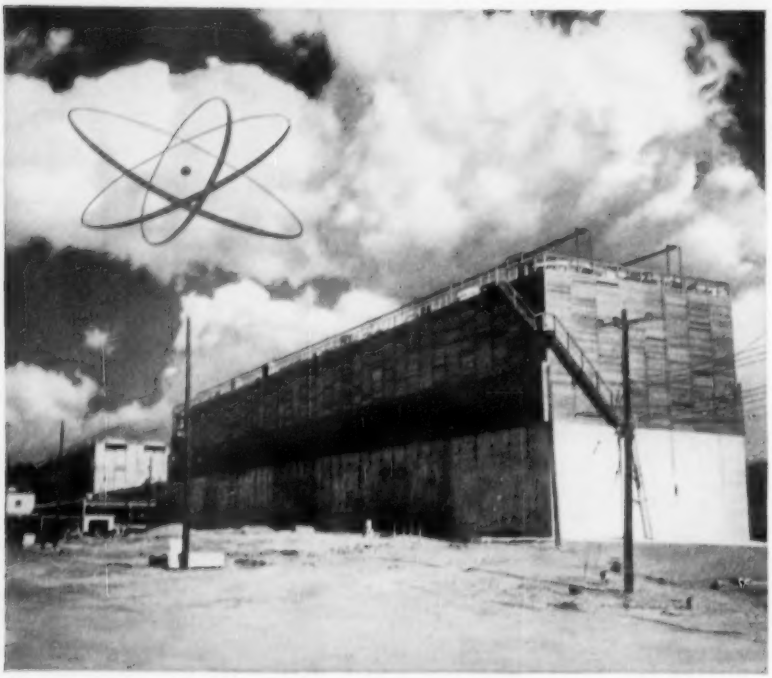

FW cooling tower
serves huge atomic plant

Now in service at a large Atomic Energy Commission plant, this 44-cell cooling tower designed and built by Foster Wheeler has a rated capacity of more than 150,000 gallons per minute. Covering an area of approximately 46,500 square feet, it is one of the largest cooling tower installations ever made.

Foster Wheeler cooling towers reflect more than 50 years of experience in meeting the specific requirements of all types of power and process plants. Each tower is engineered and constructed to give maximum performance at minimum cost.

For complete information on FW cooling towers, send for your complimentary copy of Catalog CT-52-4. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

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CALENDAR

JUNE

6-10 American Petroleum Institute, Division of Production, midyear committee conference, Brown Palace Hotel, Denver.

7-9 National Oil Scouts and Landmen's Association, 32nd annual meeting, Banff Springs Hotel, Banff, Alberta, Canada.

9-10 Natural Gas and Petroleum Association of Canada, Royal Connaught Hotel, Hamilton, Ont.

9-10 Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.

14-15 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alberta, Canada.

12-17 Society of Automotive Engineers, golden anniversary summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

16-18 Interstate Oil Compact Commission, Cosmopolitan Hotel, Denver.

17 Northern California Section, American Institute of Chemical Engineers, symposium on waste disposal, University of California, Berkeley, Calif.

20-23 American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Boston.

23-24 Western Petroleum Refiners Association, technical-industrial relations meeting, Broadview Hotel, Wichita, Kans.

23-26 Rocky Mountain Oil Show, Casper, Wyo.

26-July 1 American Society for Testing Materials, Chalfonte-Hadden Hall, Atlantic City, N. J.

JULY

20-22 Instituto Tecnologico y de Estudios Superiores de Monterrey, first annual short course on instrumentation for industry, campus, Monterrey, N. L., Mexico.

AUGUST

15-16 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

15-17 Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Ore.

29-31 15th annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

26-Sept. 15 Graduate summer session in reservoir engineering, University of Texas, Austin.

SEPTEMBER

11-13 Independent Natural Gas Association of America, annual meeting, Jasper Park Lodge, Jasper Park, Jasper, Alberta, Canada.

12-14 American Institute of Electrical Engineers, electrical conference of the petroleum industry, Shamrock Hotel, Houston.

12-16 Second International Instrument Congress and Exposition and tenth National Instrument Conference and Exhibit, Shrine Auditorium, Los Angeles.

14-16 National Petroleum Association, 53rd annual meeting, Traymore Hotel, Atlantic City, N. J.

14-17 American Association of Petroleum Geologists, western Canada regional meeting and fifth annual field conference of Alberta Society of Petroleum Geologists, Jasper, Alberta, Canada.

22-23 Western Petroleum Refiners Association, regional technical-industrial rela-

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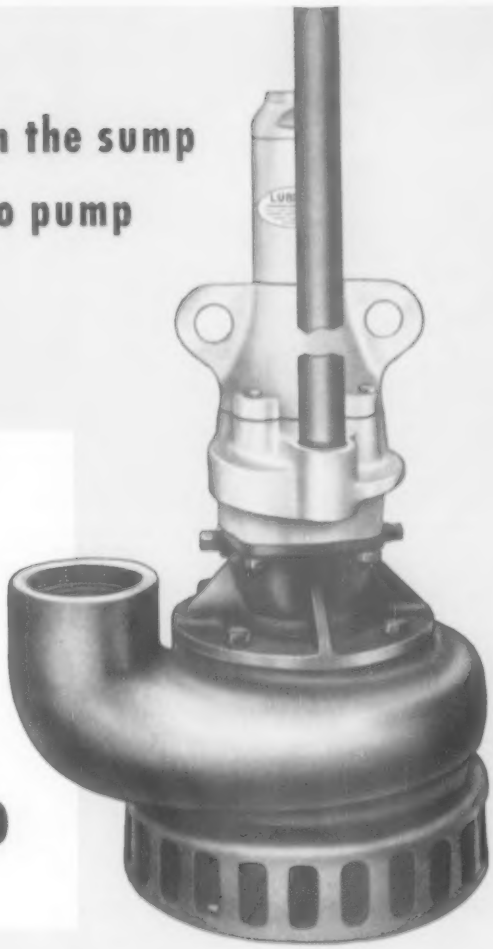
It's ready to pump



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SPECIFICATIONS	
Overall length	20"
Maximum width	12"
Size of discharge nozzle	2½" Pipe Tap
Size of discharge hose recommended	2½"
Size solids which runner will pass	¾"
Net weight	55 lbs.

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PICTURESQUE BLUE MOON STOCK AND HAY RANCH IN ROGUE RIVER VALLEY, ORE.

Ample water, deep rich soil, level land and mild climate give this 117-acre former truck farm maximum productivity. Blue Moon is a self-sufficient unit, with a lovely Colonial-style home, excellent farm bldgs. Wonderful fishing and hunting. Near Medford. Offered at $125,000. Ask for illus. leaflet G-70727.

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Beside the rushing Taylor Fork River in the magnificent Gallatin National Forest only 7 miles from Yellowstone, this 1166-acre working and dude ranch carries 100 head plus a string of horses—summers 300 head. 42 bldgs., accom. 65 guests. $175,000 furn. & eqpd. Owner would prefer selling half-interest to acceptable buyer. Ask for illus. leaflet G-70534.

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tions meeting, Hotel Henning, Casper, Wyo.

22-23 Louisiana - Arkansas Division, Mid-Continent Oil and Gas Association, annual membership meeting, Roosevelt Hotel, New Orleans.

26-28 American Association of Oilwell Drilling Contractors, fifteenth annual meeting, Rice Hotel, Houston.

OCTOBER

2-5 American Institute of Mining and Metallurgical Engineers, Petroleum Branch, fall meeting, Roosevelt Hotel, New Orleans.

2-6 American Society for Testing Materials, Committee D-2, petroleum products and lubricants, Statler Hotel, Washington, D. C.

3-4 Texas Mid-Continent Oil and Gas Association, 36th annual meeting, Baker Hotel, Dallas.

3-6 Rocky Mountain Association of Petroleum Geologists and Denver Geophysical Society, 25th annual meeting, Denver.

9-15 American Petroleum Institute, Oil Progress Week.

12-14 Gulf Coast Association of Geological Societies, annual meeting, Buena Vistal Hotel, Biloxi, Miss.

12-14 Gas Appliance Manufacturers Association, El Mirador, Palm Springs, Calif.

12-14 National Association of Corrosion Engineers, sixth biennial Permian basin tour, Lincoln Hotel, Odessa, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Ambassador Hotel, Los Angeles.

17-19 American Gas Association and Pacific Coast Gas Association, annual meeting, Ambassador, Biltmore, and Statler Hotels, Los Angeles.

18-22 National Safety Council, 43rd National Safety Congress and Exposition, Chicago.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Garrett Hotel, El Dorado, Ark.

24-27 National Association of Railroad and Utilities Commissioners, natural gas panel discussion, Asheville, N. C.

27-29 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

31-Nov. 1 Independent Petroleum Association of America, annual meeting, Jefferson Hotel, St. Louis.

31-Nov. 2 National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago.

NOVEMBER

2-4 Society of Automotive Engineers, diesel engine meeting, Chase Hotel, St. Louis.

2-4 American Association of Petroleum Geologists, Mid-Continent regional meeting, Skirvin Tower, Oklahoma City.

9-10 Society of Automotive Engineers, fuels and lubricants meeting, Bellevue-Stratford Hotel, Philadelphia.

10-11 American Association of Petroleum Geologists, Pacific Section annual convention, Biltmore Hotel, Los Angeles.

13-18 American Society of Mechanical Engineers, 75th anniversary meeting, Hilton and Blackstone Hotels, Chicago.

14-17 American Petroleum Institute, 35th annual meeting, Mark Hopkins, Fairmont, St. Francis and Palace Hotels, San Francisco.

27-30 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit.

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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING...

June Grads

WATCH out, Oil Industry! You're about to be invaded, taken over, reformed, reorganized, and revitalized by this year's crop of June graduates.

With diplomas clutched tightly in their hot fists they will swarm from the campuses this month and descend on a waiting world. At least they have the impression that the world is breathlessly awaiting their knowledge and talents, and they wonder how industry got along as well as it has without them. And the way the oil industry has been bidding for the services of technical graduates, they have some reason for this belief.

But now comes the disillusionment. Instead of starting as first vice presidents, these young grads will find themselves put through a routine of washing laboratory bottles, driving trucks, checking inventory, and similar menial tasks euphemistically known as a training program but designed principally to separate the men from the boys.

By the time this is over they will have learned something of the practical side of the oil business, will have gained some appreciation of why things are done as they are instead of according to the textbook theories, and will have got a glimmer of where and how their academic learning will fit into the day-to-day operations of their companies.

Before long they will have forgotten half of what they learned in school but will have acquired a much larger fund of know-how that they could possibly have got in a class room. Then they'll be oil men.

Oil Man Trash Man?

BESIDES being the month of brides, graduates, and poets, June is also the start of the motoring season. This is wonderful for sellers of gasoline, hot dogs, ice cream cones, and soft drinks, and for operators of motels, summer resorts, and wrecking services.

But it also causes motorists to toss out of car windows everything from cigaret butts and gum wrappers to beer cans and paper napkins, thus giving the highways a most unsightly appearance.

Some people, whose esthetic sense is greater than their practical sense, have advanced the notion that this is a problem that the oil industry ought to solve. The reasoning here might be that without gasoline the offenders wouldn't be able to get out in the country to throw their trash around; or perhaps the feeling is that the oil industry is so progressive, so public spirited, and so all-around wonderful and efficient that it could easily undertake the simple little task of preventing people from throwing things out of car windows.

At any rate, certain people have been saying that "there ought to be a law," or at least a voluntary agreement, by which all filling stations would hand motorists nice, clean "litterbags" in which to deposit all trash. The next filling station down the road would then courteously remove the filled bag and dispose of it, and also supply an empty replacement. It would be part of the service, just like wiping the windshield.

The only hitch is that oil marketers didn't relish the idea of being designated garbage collectors for a nation on wheels. So now a treaty has been signed between the Marketing Division of the American Petroleum Institute and something called Keep America Beautiful, Inc., under which both A.P.I. and K.A.B. agree that it would be nice if individual service-station operators would provide trash cans for the convenience of their customers and otherwise further the cause of roadside tidiness; but that it is not the duty of the oil industry to reform the habits of the motoring citizenry nor even to require station attendants to pick up their own gum wrappers.

But at least one oil company has done more. Tide Water Associated has just donated 1,000 old oil drums, suitably decorated and with the tops cut out, to the Clean Roadsides campaign of the California Chamber of Commerce. It's up to someone else to get motorists to use the drums, but at least Tide Water is helping the cause along.

—*Henry D. Ralph.*

The One and Only...

BAKER

CEMENT RETAINER

Used in More Ways
by MORE Operators year after year!

VERSATILITY UNLIMITED – From Squeeze Cementing to Testing Formations – from Cementing Two Strings Together to Reducing Gas/Oil Ratios – dozens of important applications are possible with the Baker Cement Retainer which also serves as a Casing Bridge Plug through the use of a Bridging Ball or a Bridging Plug.

The Baker Cement Retainer can be set on an electrical line to bring you savings of both time and money. Also by using the new Baker STINGER SUB, the tubing string can be easily "freed" from the Cement Retainer – see below.

IMPORTANCE OF DRILLABILITY – The Baker CAST IRON Cement Retainer is furnished with the body and most of the parts made of Cast Iron having the physical properties to assure ample strength and maximum drillability. For the *ultimate* in easy drillability, specify the Baker MAGNESIUM ALLOY Cement Retainer.

MAGNESIUM OR CAST IRON – You can select the type of Baker Cement Retainer exactly suited to your needs – the MAGNESIUM ALLOY Type for *temporary* applications, or the CAST IRON Type for *permanent* settings, or where harmful well fluids are present. Either type will provide a perfect pack-off, safe for any pressures that are safe for the casing.

BAKER OIL TOOLS, INC. · HOUSTON · LOS ANGELES · NEW YORK

Now you can have a "FREE" tubing string.

If it is desirable to have a "free" tubing string when cementing, it is a quick and simple matter to disconnect the tubing string from the Retainer when a Baker "Stinger Sub" is used. After the Stinger Sub has been released from the Retainer (by 15 right-hand rotations of the running-in string) the tubing can be set down on the Retainer and the seal on the *maximum bore "stinger"* of the Stinger Sub will seal off in the bore of the Retainer. Operations can then be continued as desired.

BAKER

Never stops ~~working on~~ Solving Cementing Problems

Problem: how to keep capacity ahead of demand

ONE of the paradoxes of the petroleum industry is that it keeps on expanding its capacity at a rapid rate even when it has ample capacity for current and near-future demands. As one major company observed in its recent annual report:

"The oil industry as a whole continues to spend large capital sums for improvement and expansion. The question arises as to why oil companies keep on doing this at a time when there is an excess of some 15 per cent in domestic refining capacity and probably something more in crude-oil producibility.

"The main reason is that we anticipate continued growth in the use of oil. In an industry as vital and dynamic as petroleum, companies must act in response to future as well as present considerations. Money must be spent now to provide equipment and sources of supply we will need several years hence."

PLANNING FOR A BIG FUTURE is a habit with the oil industry, and also a necessity. Several recent long-range forecasts foresee a steady and prodigious growth in demand for petroleum products. In the past, all such long-range forecasts have proved to be too modest.

It takes a tremendous amount of capital investment to keep increasing the industry's capacity, and the bulk of this capital comes from current earnings of the operators. Another major company has pointed out that during the past 10 years it has spent almost exactly half a million dollars a day to modernize and expand, and 82 per cent of this money came from its own operations.

The fly in the ointment is that at the moment the industry is somewhat overbuilt. With something like 2,000,000 bbl. per day of reserve producing capacity and with generally ample facilities in every other division in most localities, the industry could take care of quite an increase in demand with only nominal new construction.

THE PROBLEM HERE is how to keep capacity just a bit—but not too far—ahead of demand and how to carry the currently unneeded fraction of capacity.

Earnings of the industry as a whole must be maintained at a level sufficient to provide the capital for future expansion. If new capacity is put into use before it is needed, it could add to the present surplus to such an extent that earnings of many operators would be insufficient for this purpose.

But holding new capacity idle is very costly, whether it be shut-in crude, refinery units, or transportation facilities.

The only solution is to continue to base budgets and operations on the necessity of carrying a certain amount of unused capacity as a more or less regular thing.

When Marketing is the Problem

ANCHOR *Specialists . . . can do it better, more economically and at less trouble to YOU . . .*

ANCHOR'S business is the marketing of petroleum products. Every member of the big Anchor organization is enthusiastically interested in that business. Because of this single-minded interest, every department . . . from the nation-wide sales organization to the billing and accounting sections are specialists familiar with problems of marketing and efficient at dealing with them.

So, if your particular specialty is producing or refining, let Anchor take the marketing off your hands. Anchor buys and sells: LPG, Natural Gasoline, Diesel Oil, Fuel Oil, Asphalt, Commercial Solvents and Other Petroleum Products. Call Anchor — Tulsa, 2-7261.

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THIS WEEK . . . . . IN THE NEWS

Offshore

• There won't be any compromise between the federal Government and Louisiana over ownership of submerged lands in the Gulf of Mexico. Interior Secretary Douglas McKay refuses to alter plans for a federal July 12 leasing involving many tracts in the disputed areas. He says the Government will go ahead with the leasing, adding that a compromise on the ownership is out of the question. The Supreme Court must decide the issue. The court has a federal petition asking it to decide whether Louisiana's boundary is 3 miles or 3 leagues from the shore.

Production

• The 5,000-acre World field of West Texas will undergo a full-scale water flood to step up declining production. Tennessee Gas Transmission Co. will conduct the flood in the prolific Grayburg horizon. Wells in this pay have an average cumulative production of 108,000 bbl. but have dropped to 17 bbl. daily and are expected to go to 3 bbl. unless pressure maintenance is started.

• Gas injection will be undertaken this fall in Wyoming's Clareton field. Tri-Co. Gas Co. is moving a 5,000,000-cu. ft. gasoline plant from Oklahoma to handle gas from one area of the field. Dry gas will be returned to the reservoir.

Natural Gas

• The great era of ever-rising gas prices and booming pipeline projects may be nearing an end. Chairman Jerome K. Kuykendall of the Federal Power Commission believes natural-gas prices may be nearing their peak. Only a few more major transmission lines are expected. The present sellers' market in gas may then come to an end. Kuykendall says this will be particularly true if independent producers are exempted from federal regulation and natural economic forces are allowed to operate.

International

• Crude production in the free world has reached a new all-time high—the fifth record in 5 months. Average daily production in March, latest month for which figures are available, reached 13,669,100 bbl. This represents a gain of 1.3 per cent over the daily average in February.

• The Soviet Union will place greater emphasis on its oil search under the new industry-building program. It hopes to increase its oil output this year to about 1,400,000 bbl. daily, but this goal now seems a little out of reach.

• Oil prospects in France continue to brighten. Esso Standard has started production at its recent discovery several miles from the lush Parentis field and now plans to drill an offset. Socony Mobil Oil Co., through a French marketing and refining affiliate, is seeking a big exploration concession in the promising Paris basin.

• The 1953 oil discovery in Australia has been confirmed. Production was found in a nearby well after seven dry holes were drilled around the discovery. The new producer, however, is only 30 ft. from the 1953 test, which because of mechanical difficulties has never been completed.

Exploration

• Busy Beaver County in the Oklahoma Panhandle may come up with some more exploration surprises. In 1½ years the northeastern section of the county has produced nine new fields or extensions. Now geologists think the trend may swing southwest, linking the county with the rich Camrick-Grand Valley in southeastern Texas County.

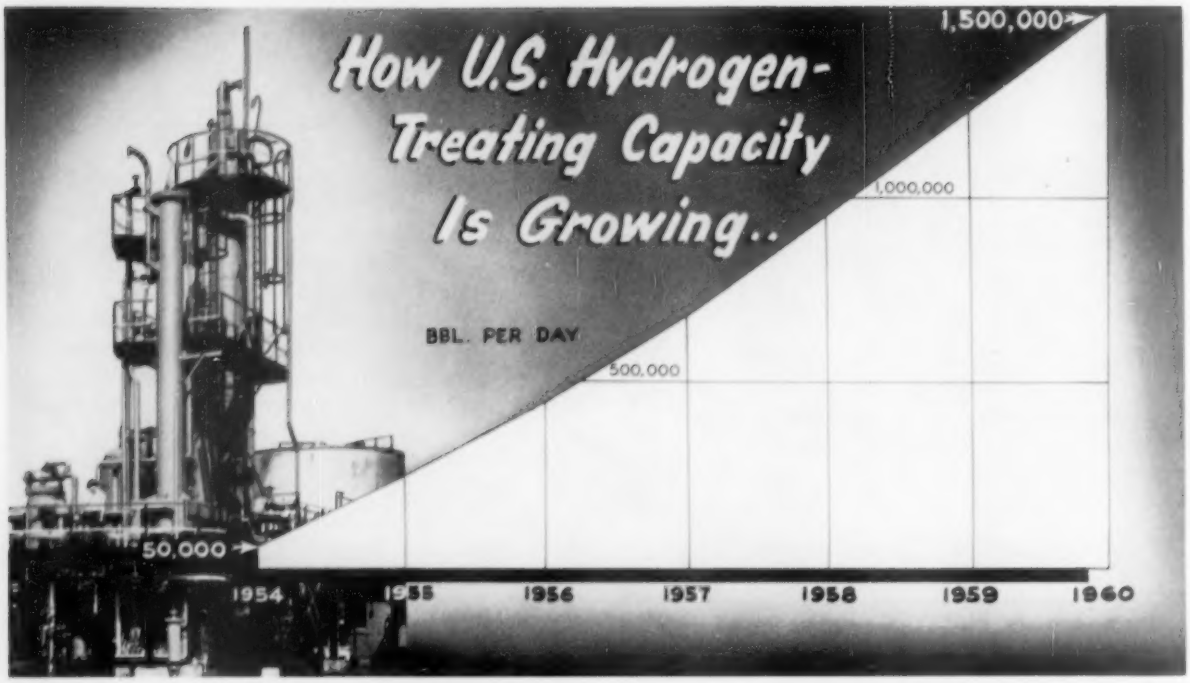
• A wildcat in southeastern Colorado gets a gas flow of 2,000 M.c.f. daily. The well, 1 Coordes & Oberlander in Bent County, recovered gas from 4,625-45 ft. The test is one of 11 wildcats being drilled in Bent and adjoining Las Animas County. It was drilled by M. J. Stansbury of Bakersfield, Calif.

• Exploration is expected to increase Colorado's reserves from 328,651,000 bbl. to 500,000,000 bbl. during the next 10 years, according to Raymond D. Sloan, western division manager for Carter Oil.

Pipelining

• Another section of the products line being built between El Paso and Los Angeles for Southern Pacific Pipe Line Inc., has been put under contract. Latest award covers a 200-mile section of 12-in. line between Colton, Calif., and Yuma, Ariz. Already awarded are sections from El Paso to Tucson.

• Westcoast Transmission Co. has tied down sufficient Peace River gas to assure distribution to new customers in British Columbia and the Pacific Northwest. It has completed contracts with 11 producers for 355 million cubic feet of gas daily for 20 years.



A new refining tool is spreading rapidly . . .

. . . The Boom Is on for Hydrogen

George Weber

HYDROGEN treating of distillates is catching on fast. Last year total capacity of such units was only 50,000 bbl. This year it's already up to nearly 200,000 bbl. daily in the United States alone. By 1960 it is conservatively estimated that United States capacity will reach a staggering 1,500,000 bbl. per day.

It's not really a new technique. But the arrival of catalytic reforming has provided a low-cost source of hydrogen which refiners can use to upgrade naphthas, middle distillates, lubes, and waxes. And they're taking advantage of it in refineries throughout the world.

World hydrogen-treating capacity now stands at about 260,000 bbl. But more than 250,000 bbl. of new capacity is now under construction in the free world and another 221,000 bbl. is definitely scheduled for the near future.

Within a few years, it is considered likely that capacity in hydrogen-treating units will exceed that of catalytic reformers.

What is it? . . . A severe form of hydrogenation, or hydrogen treating, was used commercially in both the United States and Germany before World War II. The technical know-how goes back even further.

But so-called "hydrogen treating" is relatively new. The term applies to the mild type of operation designed to desulfurize and otherwise upgrade distillate fractions. The technique is fairly simple.

The current boom in construction is due to the large amounts of byproduct hydrogen available from cat reformers and also to a brisk quality race which touches nearly all petroleum products. Refiners today must process greater volumes of lower-quality crudes into higher-quality products.

This squeeze applies not only to motor fuels but to burning oils, diesel fuels, lubricating oils, waxes, solvent naphthas, and even residual fuels. In all but residuals, hydrogen treating is lending a hand. And the time is arriving when even whole crudes and residual fractions may be commercially upgraded by hydrogenation.

How does it work? . . . The term hydrogen treating embraces a wide variety of catalytic reactions.

To date its greatest application has been the conversion of sulfur compounds—both mercaptans and ring-sulfur types—to hydrogen sulfide, which is removed easily from products.

This type of desulfurization is widely used to sweeten cat reformer feed stocks, gasoline blends, burning oils, diesel fuels, and to a lesser extent, solvents, lubes, and waxes. It is a big improvement over former treating methods and bids fair to become common practice in refineries charging sour crudes.

But hydrogen treating does not stop there. Under varying conditions of pressure and temperature, hydrogen also can be combined with nitrogen and oxygen, which contaminate some petroleum hydrocarbons. These conversions generally result in end products of ammonia and water, again readily removed from the liquid hydrocarbons. The result: better cat-cracking stocks and products with improved color, odor, and stability. Further benefits are reduction in air pollution and lessened equipment corrosion.

To an extent not yet revealed specifically, hydrogen can be combined with certain contaminant metals present in crude-oil fractions. Vanadium, arsenic, and sodium can be eliminated or neutralized by catalytic combination with hydrogen, thereby reducing catalyst poisoning in later processing and resulting in a higher quality product.

Finally, a light touch of hydrogen will do wonders for many cracked stocks. The partial saturation of diolefins improves product stability and prevents such unsaturates from forming

WORLD DISTRIBUTION
(B.P.S.D.)

	U.S.	Foreign	Total
Operating	233,110	24,880	257,990
Building	193,470	58,550	252,020
Planned	208,590	12,450	221,040
Total	635,170	95,880	731,050

BREAKDOWN OF USAGE*
(B.P.S.D.)

Catalytic reformer feed stocks	341,500
Middle distillates	371,100
Lubricating oils	12,500
Waxes	2,800
Specialty naphthas	3,150
Total	731,050

*Operating, building, and planned.

gum or combining with oxygen during storage.

Some cracked gasolines can be improved for storage stability with little or no loss in clear octane. Cracked diesel fuels can be saturated for substantial cetane number improvement. Going further, smoke points of No. 1 fuel oil can be improved by conversion of low-quality aromatics to naphthenes and reduction in naphthalene content.

These varied reactions can be controlled by selection of catalyst and use of proper temperature, pressure, and space velocity. Most catalysts now used for mild hydrogenation contain cobalt or molybdenum, or both. Tungsten, nickel, and platinum are also used. Oxides of these metals are generally supported on alumina, silica or silica-alumina.

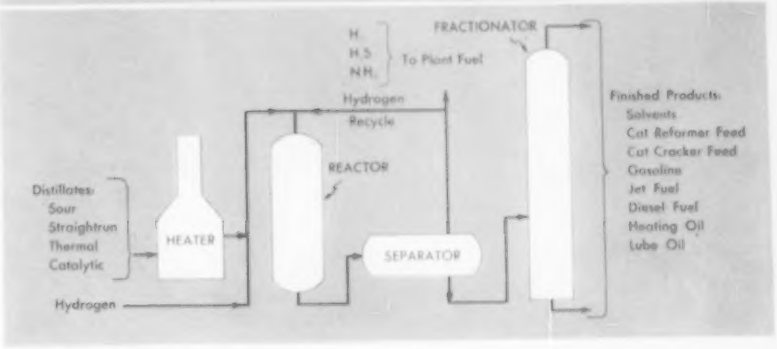
Operating conditions are selected according to the content of contaminants, including olefins and diolefins, in the feed stocks, and the desired degree of their removal, or saturation. In nearly all cases pressures of less than 1,000 psi. will do the job.

Hydrogen requirements also vary widely, from 2 or 3 cu. ft. per barrel of wax treating to 300 or 400 cu. ft. per barrel for desulfurizing and saturating some cracked burning oils.

Only in severe hydrocracking and desulfurizing of whole crudes or residual fractions does the hydrogen requirement climb higher on a per barrel basis than the net production of most cat reformers. Thus, the refinery with a cat reformer sized for handling its heavy-naphtha fraction can remain self-sufficient on hydrogen for treating reformer feed stocks and middle distillates as well.

What are the processes? . . . There are now 16 variations of the mild hydrogen-treating process. Some are available for licensing and others are being employed only by the companies which developed them, at least for the present.

How Hydrogen Treating Works



The most widely used process is Unifining, developed and licensed jointly by Universal Oil Products Co. and Union Oil Co. of California. This process is finding successful application to a wide range of petroleum fractions.

From the standpoint of application, Hydrofining, developed by Esso Research & Engineering Co., is second in importance. This process covering the full range of mild hydrogen-treating operations is being applied primarily by companies affiliated with Standard Oil Co. (N. J.), although it is available to other companies.

Development work is by no means restricted to United States companies. British Petroleum Co., Ltd., was early in the field with Autofining and B.P. Hydrofining, and the Royal Dutch-Shell has made its "Trickle" process called Hydrodesulfurization available for licensing for many months.

Shell Oil Co. has been practicing its Hydrofining process for 10 years in two units built during the war, and is now extending the operation to two other plants. Husky Oil Co. is planning to expand use of its own Diesulforming, and Standard Oil Co. (Ind.) will probably announce further commercial application of its version of Hydrodesulfurization, now in two refineries. Hydrobon was the name given to U.O.P.'s original process and only one unit was licensed under that name before it was changed to Unifining.

The Texas Co. is using its own version called Hydrotreating in one refinery, and has licensed Unifiners for all other plants where Platformers are going in. Sun Oil Co., with one unit operating on lube oils, is planning further work. Houdry Process Corp.'s Hydropretreat consists of a guard case on some Houdriforming units, using the same platinum type catalyst employed in the reformer proper.

Among the newcomers to this field are Gulf Research & Development Co., which plans to build two big Gulfining units for treating virgin and cracked burning oils for sulfur removal and improved stability. Ashland Oil & Refining Co. also plans to incorporate a modification of hydrogen treating in three refineries. A pretreating operation using recycle hydrogen has been developed by M. W. Kellogg Co. It is included as an integral part of a new catalytic reformer built for Pure Oil Co. and will be specified for other future catalytic reformers.

Sinclair Research Laboratories are working on a new catalyst which will be employed in a hydrofinishing operation. The first commercial application of this process will be made at Sinclair's Houston and Marcus Hook refineries, where catalytic reformer hydrogen will be available. At least two other major oil companies are in the final stages of developing and announcing their own versions of hydrogen treating, and many other companies, large and small, are engaged in similar programs.

Where are we headed? . . . At this stage in the rapidly changing picture, the domestic use of this new refining tool is about equally divided between upgrading of catalytic reformer feed stocks and improving middle distillates—mainly No. 2 fuel oils.

Lube oils, waxes, and odorless naphthas are only beginning. Total capacity to be devoted to processing these product types will remain minor, but wide application is anticipated.

Two yardsticks, used conservatively, show how far hydrogen treating may go in the next 5 years.

. . . Integration of hydrogen pretreating units into all catalytic reformers by many refiners is one indicator. One major oil company and a number of small refiners have adopted such a program.

In this group the capacity of hydrogen treating for reformer feed stocks alone equals or exceeds total reforming capacity.

Total reforming capacity in the United States is due to reach 1,000,000

bbl. daily within the next year. It may be conservatively projected to 1,500,000 bbl. by 1960, since many refiners already are beginning their second round of reformer building. Assuming that only 60 per cent of the cat reformers in operation by 1960 are packaged with hydrogen-pretreat units, capacity for that operation alone would reach 900,000 bbl. per day.

. . . Another indicator is the present policy of some major and independent companies of installing hydrogen-treating units for middle distillates amounting to about 10 per cent of crude capacity.

If only 5 per cent of projected total crude capacity is represented by such units in 1950, middle-distillate hydrotreating could reach 500,000 bbl. per day.

Thus, a very conservative estimate indicates there will be 1,500,000 bbl. of capacity in operation in 1960 upgrading virgin and cracked naphthas and distillate fuels, lubes, waxes, and specialty products.

What of residuals? . . . The more severe hydrocracking and desulfurization of whole crudes and residual fractions is another matter. But past history, coupled with recent developments, strongly indicates that this type of operation will definitely appear commercially before 1960.

Prewar operations of this type were practiced in Germany and the United States. Economics did not favor this expensive process here, but it saw extensive use in Germany during the war for manufacturing aviation gasoline.

Since then, hydrogenation of heavy petroleum fractions has continued and is considered competitive in that country. Three refineries in West Germany now operate high-pressure hydrocracking facilities which have a total charge capacity of more than 28,000 bbl. per day.

Meanwhile, several United States companies have continued the research on hydrogenating heavy-oil fractions. Five years ago, Standard Oil Co. (Ohio) reported on a hydrodesulfurization process using a catalyst comprising oxides of cobalt, molybdenum, and aluminum. Sulfur removal was obtained in the laboratory at 750° F. and only 300 psig.

More recently, Gulf Research & Development Co. reported on a 10-year research program which resulted in its Gulf HDS process. This operation, combining hydrocracking and desulfurization of whole crudes, vacuum bottoms and blends of residual and heavy catalytic recycle stocks, has been carried out in a 50-bbl. pilot plant.

Pressures ranged from 500 to 1,000 psig. Gulf spokesmen admit to sizable

Hydrogen Treating

AUTOFINING (British Petroleum)

Refining company and plant location—Type feed stocks—	Unit capacity (B.P.S.D.)	Status
Aden Petroleum Refinery, Ltd.:		
Aden—Power kerosine	3,500	Operating
National Oil Refineries, Ltd.:		
Llandarcy, Wales—Tractor fuel	3,500	Operating
Grangemouth Petroleum Refinery, Ltd.:		
Grangemouth, Scotland—Various (experimental)	500	Operating

DIESULFORMING (Husky)

Husky Oil Co.:		
Cody, Wyo.—Diesel fuel	1,000	Operating
Husky Oil & Refining, Ltd.:		
Fort Williams, Ont.—Diesel oil	*1,000	Building
Moose Jaw, Sask.—Diesel fuel	*900	Building

GULFINING (Gulf)

Gulf Oil Corp.:		
Port Arthur, Tex.—Straightrun burning oil	20,000	Planned
Port Arthur, Tex.—Cat. cracked burning oil	25,000	Planned

HYDROBON (U.O.P.)

Standard Oil Co. (Ohio):		
Lima, Ohio—Cat. Reformer feed (12,000), Burning oil (1,000)	13,000	Operating

HYDRODESULFURIZATION, Trickle Process (Royal Dutch-Shell)

"Shell" Refining & Marketing Co., Ltd.:		
Stanlow, England—Gas oil	5,000	Operating
Canadian Petrofina, Ltd.:		
Montreal, Que.—Gas oil	3,000	Building
Shell Oil Co. of Canada:		
Montreal, Que.—Virgin gas oil	7,500	Building

HYDRODESULFURIZATION (Standard of Indiana)

Great Northern Oil Co.:		
St. Paul, Minn.—Distillate stocks	11,000	Building
Standard Oil Co. (Ind.):		
Whiting, Ind.—Burning oil	5,000	Operating

HYDRODESULFURIZATION, Vapor Phase (Shell Development)

Shell Oil Co.:		
Anacortes, Wash.—Cat Reformer feed stocks	8,000	Building
Houston, Tex.—Distillate stocks	16,000	Planned
Wilmington-Dominguez, Calif.—Cat. and thermal cracked naphthas	12,000	Operating
Wood River, Ill.—Burning oils, mineral spirits	11,000	Operating

HYDROFINING (British Petroleum)

B. P. Benzin Petroleum G.m.b.H.:		
Hamburg, Germany—Virgin and cracked diesel fuels	6,500	Building
British Petroleum Co., Ltd.:		
Kwinina, Australia—Kerosine, gas oil	6,500	Operating
Kent Oil Refinery, Ltd.:		
Isle of Grain, England—Virgin and cracked diesel fuels	10,000	Building

HYDROFINING (Esso)

Carter Oil Co.:		
Billings, Mont.—Distillate stocks	6,900	Building
Esso A.G.:		
Hamburg, Germany—Diesel fuel	8,450	Building
Esso Petroleum, Ltd.:		
Fawley, England—Diesel fuel	3,700	Operating
Fawley, England—White spirit	1,500	Operating
Esso Standard Oil Co.:		
Baltimore, Md.,—Light virgin, light coker and heavy cracked naphtha	12,000	Building
Baltimore, Md.—Heavy virgin naphtha	3,000	Building
Baltimore, Md.—Heavy cracked heating oil	5,000	Building
Baton Rouge, La.—Virgin gas oil	26,200	Planned
Baton Rouge, La.—Coker gas oil and naphtha	12,740	Planned
Bayonne, N. J.—Wax	2,500	Operating
Everett, Mass.—Heavy cracked naphtha	2,400	Planned
Everett, Mass.—Heavy cracked heating oil	2,250	Planned
Linden, N. J.—Heating oil	7,640	Operating
Linden, N. J.—Cracked heating oil	19,520	Operating
Esso Standard, S.A.F.:		
Port Jerome, France—Virgin gas oil	8,450	Planned
Humble Oil & Refining Co.:		
Baytown, Tex.—Heating oil	20,000	Operating
Baytown, Tex.—Expansion of unit above, additional	16,000	Building
Baytown, Tex.—Lube oils	8,770	Building
Baytown, Tex.—Heavy cracked naphtha	15,000	Operating
Imperial Oil, Ltd.:		
Edmonton, Alta.—Lubes	2,000	Building
Sarnia, Ont.—Lubes and waxes	600	Operating
Leonard Refineries, Inc.:		
Alma, Mich.—Distillates	4,200	Building

Around the World

HYDROPRETREATING (Houdry)

Refining company and plant location—Type feed stocks—	Unit capacity (B.P.S.D.)	Status
Ashland Oil & Refining Co.:		
Catlettsburg, Ky.—Cat reformer feed stocks	6,000	Building
Commonwealth Oil Refining Co., Inc.:		
Guayanilla Bay, Puerto Rico—Cat reformer feed stocks	3,700	Building
Crown Central Petroleum Corp.:		
Houston, Tex.—Cat reformer feed stocks	5,000	Operating
Gewerkschaft Erdoel-Raffinerie Emsland:		
Lingen, Germany—Cat reformer feed stocks	3,500	Building
Ohio Oil Co.:		
Robinson, Ill.—Cat reformer feed stocks	8,000	Operating
Western States Refining Co.:		
North Salt Lake, Utah—Cat reformer feed stocks	1,000	Planned
Undisclosed	500	Planned

HYDROTREATING (Texaco)

The Texas Co.:		
Wilmington, Calif.—Cat reformer feed stocks	10,000	Building

SOVAFINING (Socony Mobil)

Magnolia Petroleum Co.:		
Beaumont, Tex.—Light and middle distillates	30,000	Planned
Socony Mobil Oil Co., Inc.:		
Paulsboro, N. J.—Light and middle distillates	*25,000	Planned

UNIFINING (Union-U.O.P.)

Aurora Gasoline Co.:		
Detroit, Mich.—Cat reformer feed stocks	7,500	Building
Caltex Petroleum Mij. (Nederland) N.V.:		
Pernis, Netherlands—Middle distillates	4,000	Planned
Eastern States Petroleum Co.:		
Houston, Tex.—Gas oil	6,000	Operating
Houston, Tex.—Middle distillates	7,000	Building
Elk Refining Co.:		
Falling Rock, W. Va.—Cat reformer feed stocks	1,500	Operating
Frontier Oil Refining Co.:		
Cheyenne, Wyo.—Cat reformer feed stocks	3,000	Building
McColl-Frontenac Oil Co., Ltd.:		
Montreal, Que.—Cat reformer feed stocks	12,000	Building
Mid-West Refineries, Inc.:		
Alma, Mich.—Cat reformer feed stocks	2,500	Building
Pennzoil Co.:		
Rouseville, Pa.—Cat reformer feed stocks	3,400	Building
Phillips Petroleum Co.:		
Borger, Tex.—Cat reformer feed stocks	10,000	Building
Standard Oil Co. of California:		
El Segundo, Calif.—Cat reformer feed stocks	22,200	Building
Richmond, Calif.—Cat reformer feed stocks	22,200	Building
The Texas Co.:		
Amarillo, Tex.—Cat reformer feed stocks	4,800	Operating
Casper, Wyo.—Cat reformer feed stocks	4,800	Building
El Paso, Tex.—Cat reformer feed stocks	3,300	Operating
Lawrenceville, Ill.—Cat reformer feed stocks	13,500	Operating
Lockport, Ill.—Cat reformer feed stocks	11,000	Building
Port Arthur, Tex.—Cat reformer feed stocks	20,000	Operating
Port Arthur, Tex.—Cat reformer feed stocks	20,000	Operating
West Tulsa, Okla.—Cat reformer feed stocks	9,000	Building
Westville, N. J.—Cat reformer feed stocks	12,000	Operating
Tide Water Associated Oil Co.:		
Avon, Calif.—Cat reformer feed stocks	10,500	Operating
Delaware City, Del.—Cat reformer feed stocks	*30,000	Planned
Union Oil Co.:		
Oleum, Calif.—Cat reformer feed stocks	15,750	Operating
Cut Bank, Mont.—Diesel fuel	250	Operating
United Refining Co.:		
Warren, Pa.—Solvent naphthas, specialty distillates	750	Operating

UNNAMED PROCESSES

(Ashland Oil & Refining Co.)

Ashland Oil & Refining Co.:		
Buffalo, N. Y.—Middle distillates	5,000	Planned
Catlettsburg, Ky.—Middle distillates	8,500	Planned
Findlay, Ohio—Middle distillates	4,000	Planned

(M. W. Kellogg Co.)

Pure Oil Co.:		
Newark, Ohio—Cat reformer feed stocks	3,000	Operating

(Sun Oil Co.)

Sun Oil Co.:		
Marcus Hook, Pa.—Lube oils	1,500	Operating

*Estimated.

costs for a commercial application of this process. But they add that the benefits derived from desulfurization and partial conversion of residual to distillate fractions make the process comparable in payout to the best means of conventional processing today.

At this early stage, the commercial application of hydrogenation to residuals cannot be forecast with any accuracy. It is possible that some units will be contracted within the next 18 months.

A look ahead . . . But use of this highly versatile processing tool for the upgrading of distillates will spread rapidly. Enough hydrogen will be available from reformers to carry the load in improving distillates in almost all refineries.

Directors of some research laboratories today foresee the time when refiners will need even more hydrogen and will install additional facilities for that specific element. That day will arrive when they adapt the more severe hydrogenation technique to desulfurization and conversion of residual fractions.

The know-how is available now. Commercial application will follow when the economic situation permits. Regardless of the timetable, refiners are now well into the new era of hydrogen treating; a timely and versatile means of improving product quality.

GULF COAST

Texas Oil Firms Merge

HOUSTON.—Stockholders of Livingston Drilling & Well Service, Inc., have approved a merger with Petroleum Management Co. and transfer of assets of both firms to the newly-chartered Union of Texas Oil Co.

Union of Texas will be active in the Gulf Coast area. It has producing oil wells in the Joyce Richardson field in Harris County.

Pending their formal election later, principals of the merged companies will serve as officers. S. Russel Casey is temporary president; L. L. Seiffert, Jr., secretary-treasurer; B. W. Shudds, vice president; Herbert C. VonEiff, vice president and assistant secretary; and H. S. Eddings, vice president in charge of production.

Pure Expands at Beaumont

BEAUMONT, Tex.—Pure Oil Co. will install a 15,000 bbl. per day catalytic reformer and a 20,000 bbl. feed preparation unit at its Smiths Bluff refinery near here. Contract for the work has been let to the Ralph N. Parsons Co. of Los Angeles.

Gas Prices Near Peak

Top of market in sight, only few more big transmission lines expected, FPC chairman assures Senate committee

Bertram F. Linz

WASHINGTON.—Natural-gas prices may be nearing the top of the market. Only three or four more major transmission systems are expected to be built. When the transportation structure is completed, the present sellers' market in gas may come to an end.

That is the word of Federal Power Commission Chairman Jerome K. Kuykendall.

This will be particularly true, Kuykendall told the Senate interstate commerce committee, if a bill exempting independent producers from federal regulation is passed.

As the Senate committee worked to wind up its hearings, the House interstate commerce committee whipped the Harris bill into final shape. At its first meeting last week it wrote a policy of equality for all fuels, but turned down a proposal to give the FPC control over direct industrial sales of gas by pipelines.

The committee's policy statement called on the FPC to see that productive capacity of all the fuel industries is sufficient to meet the present and future needs of the country.

It called for the adoption of conservation principles to "preserve gas" for purposes which will afford maximum long-range benefits to the public with due regard for the conservation policies and regulations of the producing states.

Controls opposed . . . Kuykendall told the Senate committee there is no more reason to regulate gas than to regulate oil or coal. But Senator Pastore of Rhode Island, acting chairman, argued that gas consumers are tied to a single pipeline which in turn is tied to its gas supply, while oil and coal may be bought from a number of sources. Gas is a sellers' market, he went on, and any commodity in that situation should be controlled.

"If oil ever becomes a sellers' market it should be supervised too," Pastore declared.

Pastore said he has an open mind on the handling of the gas problem. But he said also he believes gas should be regulated from producer to local distributor. He would be willing to exempt producers of less than 2,000,000 M.c.f. a year from regulation, as provided in the Heselton bill. But he would give the FPC the right to review all contracts made since 1938 and wipe out spiral escalation clauses.

All five power commissioners appeared before the committee. Kuykendall spoke for the four who favor the Harris bill. Commissioner Claude Draper, who wants the Phillips decision kept effective, declined to testify.

Difficulties cited . . . Sharply questioned by Pastore, Kuykendall pressed a number of points.

It would not be impossible to carry out the Supreme Court mandate in the Phillips case. But it would be extremely difficult due to lack of direction as to the standard to be followed to determine if a producer's price is fair.

The Fulbright bill (the Senate version of the Harris bill) provides for the "reasonable market price." That is broader than the "weighted average field price" base adopted by the FPC in the Panhandle case last year. But it might not result in higher prices to producers.

Utility type regulation is not workable in the case of producers. Any control should be patterned after the antitrust laws, so as not to wipe out competition.

The bills as now written would not prevent higher prices in new contracts from "triggering" favored-nation escalation clauses in existing contracts. FPC would not object to an amendment giving it the power to review all contracts made since enactment of the Natural Gas Act in 1938 which, with the bills' prohibition upon spiral escalation clauses, would give the commission control of the situation.

Changes urged . . . Whatever Congress does in the matter, the commission urges two changes in the law. Independent producers should not be required to secure sales certificates. Aside from the lack of need for certification to carry out the Phillips decision, it would deprive producers of all rights to abandon service without FPC permission. And it should be made clear that the FPC could regulate area by area or field by field and not be restricted to company by company regulation.

Kuykendall testified that under the Phillips decision FPC might not be able to use the field-price formula adopted in the Panhandle case. The $64 question is what standard the commission should follow.

Last fall the commission invited all interested persons to make suggestions on this point. First in writing, then in oral argument, producers, pipelines, investors, consumers and public officials told what they thought it should do.

It all boiled down to two ideas, Kuykendall said. Some urged the FPC to use original cost. That would not work in the case of pipeline-produced gas. Others held the commission should recognize prices reached in arms' length negotiations.

The FPC itself has been unable to write a standard.

Formula needed . . . The FPC needs a directive from Congress in the shape

Among Refinery's Towers

This genuine Lummi Indian totem pole outside the gates of General Petroleum Corp.'s new Ferndale, Wash., refinery is believed to be the only such adornment of any refinery in the world. Likewise, this is probably the only pole in the world whose "top man" is a "Flying Red Horse." Viewing the new show piece are B. L. Rodzianko (left), assistant manager, and Curtis Courtelyou, manager.

of a formula to be followed, Kuykendall said. The big guess is what sort of formula the courts would uphold. The commission majority believes the courts would accept prices set on the basis of the Harris-Fulbright bill.

Kuykendall admitted that no matter what happens to the Harris bill gas prices may continue to go up in some areas. But under the bill, he said, the rise would be at least slowed down.

There have been threats that if the bill is not passed producers will not sell their gas interstate. Some producers have shied away from contracts, Kuykendall said, waiting to see what happens. But there may be much "scare talk" on the point. When the dust settles down, Kuykendall believes the producers will sell where they can get the most for their gas.

"Everyone seems to think that price will continue to go up forever," Kuykendall said. "Actually, price may be at about its top, with a possibility gas may not go any higher even if not regulated."

Producers different . . . Producers should not be regulated because they are in a competitive position, Kuykendall pointed out. But transportation always must be regulated because it is a monopoly.

Other developments in the gas situation included a statement by the American Iron and Steel Institute that uncertainty over price control has already caused a postponement of three pipeline projects and the shutdown of a major pipemill.

And while organized labor charged that the Harris bill would cost consumers $800,000,000 a year, producers were equally certain that failure to pass it would result in higher consumer prices.

Consumer argument . . . A CIO spokesman, Donald Montgomery of the United Automobile Workers, told the committee the bill also would clear the way for corresponding increases in the cost of fuel oil, bring higher consumer electric bills, enhance the value of present natural-gas reserves by as much as $30 billion, and "confiscate" the investment of consumers in home gas heating equipment.

But in a statement prepared for the committee, A. P. King, Jr., president of the Texas Independent Producers and Royalty Owners Association, took the opposite view. The Phillips decision, he said, would obligate the FPC to "do something" about the vast quantity of Texas gas selling for as little as 2 and 3 cents per M.c.f. Consumers at distant points would have to bear the additional cost.

WATCHING WASHINGTON

Bertram F. Linz

Tidelands Dispute Rages

Operators looking for leases off the coast of Louisiana are going to be right in the middle of the federal-state boundary squabble.

Interior Department officials are determined to go ahead with the July 12 sale of submerged-land leases. The area open for leasing includes 73,500 acres between 3 and 10½ miles off the coast.

Last month, the Justice Department asked the Supreme Court to toss out Louisiana's claim to a 3-league boundary. The department said the state was entitled to the submerged lands only out to the 3-mile boundary.

A few days before the department's action, Interior listed the tracts it would lease July 12 off the coasts of Louisiana and Texas. Officials of the Louisiana Mineral Board made a quick trip to Washington. They asked the department to hold off on leases in the disputed zone, as it did last year.

This time the situation was different. Formal action had been taken to give the Government everything beyond the 3-mile line. So far as the Government is concerned, when it stakes a claim, that's it—unless and until the courts rule otherwise. So the department is going ahead with the sale.

If the Supreme Court upholds Louisiana's claim, the disputed area will go back to the state, of course. And the federal Government will pay over all money it has collected in bonuses and rentals. But until the matter is settled, operators in the twilight zone won't know who their permanent landlord will be.

Price Fixing Charged

The Justice Department secured the indictment last month of a New Jersey gasoline dealers' association for alleged conspiracy to increase the retail price of gasoline and make it uniform throughout the state.

That's a local matter. But it may develop into something much more far-reaching. It could be the springboard for an attack on oil-industry pricing practices.

Both the Justice Department and the Federal Trade Commission for years have eyed the industry's pricing with disfavor. But neither has ever been able to find a loophole through which it could formally test it.

The Garden State Retail Gasoline Dealers Association is charged with having tried to dictate the price which all service stations should charge for gasoline. Allegedly, it backed up its demand with threats of personal violence, picketing, and the blockading of stations which did not fall in line. Such practices are called horizontal price fixing.

But Asst. Atty. Gen. Stanley N. Barnes, head of the antitrust division, thinks there may be some vertical price fixing involved, too. His New York staff is investigating whether there has been any fixing of dealer prices by agreements between individual dealers and the oil companies which supply them.

The situation will bear watching. Any action taken against suppliers in the New Jersey area could be the tip-off of a nationwide drive.

Natural-Gas Sales Up

The natural-gas industry made some new records in the 1954-55 heating year.

Compared to the preceding year, interstate pipeline sales were up more than 8 per cent. Gas operating revenues were up 13 per cent, topping the $1,500,000,000 mark for the first time. Net income increased by more than 7 per cent.

The Federal Power Commission added up the figures. It found that the 37 regulated pipeline companies sold 6,373,716,000 M.c.f. of gas compared to 5,891,833,000 M.c.f. in the 1953-54 season. Most of the increase was in sales to other utilities. Sales to ultimate consumers accounted for only a scant 25 per cent of the total.

The companies bought almost as much gas as they sold. They bought 8.1 per cent more than in the preceding year. But they paid the producers 16.4 per cent more for what they got. They paid $815,287,493 for 6,173,827,000 M.c.f. The year before, they paid $700,387,553 for 5,710,683,000 M.c.f. The pipelines don't report the volume of their own production. But what they produced cost them $32,599,986 against $23,683,902 in 1953-54.

Pipeline operating revenue was $1,667,539,584 against $1,474,399,752 in the preceding year.

Compromise Blocked

U. S. stands pat on decision to fight Louisiana's 3-league boundary claim, refuses to alter offshore lease sale

WASHINGTON.—There will be no compromise with Louisiana over the state's claim to a 3-league boundary in the Gulf of Mexico.

That was the word passed out by the Interior Department after a conference between Secretary Douglas McKay and members of the Louisiana Mineral Board.

McKay refused to alter the schedule of tracts off the Louisiana coast on which oil and gas leases will be sold July 12. Board members had asked that he withdraw 28 tracts totaling 73,000 acres lying between 3 miles and 3 leagues off the coast.

A department statement hinted that this position was based on the opinion by Atty. Gen. Herbert Brownell, Jr., that Louisiana has only a 3-mile boundary. Department officials feel that the state has attempted to bite off too much of the Continental Shelf. They pointed out that state claims area running out as much as 35 miles into the Gulf in some places.

To name commission . . . But the department is willing to go along with the state on one point. McKay was receptive to a proposal that a special commission be appointed to work out location of the actual coast line. Board members said such a commission would aid in quickly settling the dispute whether certain areas along the coast are inland waters or open sea. McKay agreed that if a way could be provided to pin point the Louisiana coast line it might speed up the decision of the Supreme Court.

The question of whether Louisiana's seaward boundary is limited to 3 miles or, like that of its sister state of Texas, runs 10½ miles into the gulf will be settled by the Supreme Court. Brownell asked the court last month to hold the state to 3 miles. He said the enabling act under which Louisiana came into the Union gives the state the islands lying within 3 leagues of its coast. But that, he declared, does not mean that the state also got the waters within that 3-league area and another 3 leagues beyond the islands.

No precedent . . . Meeting with McKay and department officials were John Olvey, chairman; Wesley Clanton, vice chairman, and Lamar Bryant of the Louisiana Mineral Board.

They asked that the department follow the course that it took last year. The first sale of leases off Louisiana was scheduled to include a number of tracts in the contested twilight zone. After a conference with board members, McKay withdrew those tracts. But the department officials said that was a "one shot" action. It was not a precedent to be followed indefinitely.

Since none of the tracts to be leased next month is in any of the areas where the actual location of the coast line is in dispute there was no reason to withdraw them, since the Government now has made formal claim to the area.

Controls Doubtful

Standby powers helpful but not essential, Ike decides

WASHINGTON. — The administration has dropped its plan to ask Congress to write standby price and wage controls against a possible emergency.

President Eisenhower told a news conference last week that a law permitting a quick freeze of prices and wages would be a good thing if:

. . . It could be limited to the bare essentials.

. . . It could be enacted without raising a lot of fear throughout the country that the international situation was more serious than disclosed.

But the country's thinking now seems to make it unwise to bring the matter up, he said. The President pointed out that Congress could be called into session quickly if an emergency arose.

Even if the administration doesn't ask for controls, they may be brought up for discussion when Congress gets around to extending the Defense Production Act later this month. Some members have long believed a control law should be on the books. They say it would avoid the delays which arose in getting the economy regulated at the outbreak of World War II and again when the Communists invaded South Korea in 1950.

The Defense Production Act already contains the basis for material controls. To this would be added authority to freeze prices and wages for a period of 90 days at the outbreak of an emergency. Within that period, the Government would learn whether it was engaged in all-out war or in a less serious action. If the former, the freeze would slide into outright control of prices and wages, rationing, and other steps. If the latter, the freeze could be lightened or lifted entirely as the situation developed.

Imports Studied

Cabinet committee revising data for President's use

WASHINGTON.—The cabinet fuels committee is in business again.

The committee's staff is updating the statistics on which it based its recommendation for voluntary control of imports last February (*The Oil and Gas Journal, March 7, page 85*). Its suggestion was written into a bill extending the Reciprocal Trade Act. The bill, now in the hands of a conference committee and due to be enacted this month, gives the President the power to limit oil imports, by quota or other action, if they threaten to impair national security.

There are no indications whether the committee plans to make any new recommendations in the light of developments since February.

Observers believe the committee wants the President to have up-to-date information on oil imports when the reciprocal trade bill gets to him for approval. Spokesmen for several producers' associations have said they will ask the President to use his control authority as soon as the bill is signed.

The bill provides that if the mobilization director believes the volume of imports is excessive he shall so report to the President. The President then may order an investigation. If study shows imports are too high, he may "adjust" them. The type adjustment is not outlined. Presumably, the President may impose quotas or deal with the matter in some other way. But he does not have the power to increase the excise tax on imports to a point where imports would become uneconomic, estimated by producers at around $1.05 per barrel.

The cabinet committee recommended that the importing companies keep their entries of foreign oil to the same proportion to domestic production that was recorded in 1954. The Senate finance committee, in writing the control provision, said it would carry out that recommendation. It is expected the 1954 relationship will be the base on which the cabinet committee will lay its new figures, and the base on which Mobilization Director Arthur S. Flemming would make any recommendation to the President.

The present Reciprocal Trade Act is due to expire June 12. Accordingly, it is expected that the extension bill will become law this week.

Oil Plants to Get A-Bomb Test

WASHINGTON. — A make-believe atom bombing of 50 important cities this month will give defense officials new ideas on how the oil industry can bear a real attack. Industry observers also will learn how much refinery and storage facilities might be lost, and ways to protect or replace them quickly.

A number of refineries are located in cities selected for "Operation Alert." The cities were selected from among the 92 areas the Government believes would be the most attractive targets for an enemy. Whether management and personnel of the plants will participate in the exercise will be up to local authorities, who have a free hand in testing their civil defense plans.

The test will be held June 15. Air Force and Civil Defense headquarters will warn city officials they will be "bombed" within 2 to 3½ hours. In Washington, the warning will be the signal for some 15,000 key government workers to pick up vital records and leave the city for points several hundred miles distant. These have been prepared as temporary headquarters for essential agencies. The Government will "operate" from those points the rest of the week.

The alert is one of a series to be run to help Civil Defense officials solve problems of preparation for an attack, protection during it, and rehabilitation afterwards. But it also is aimed at giving military officials ideas on what must be done to insure a continued flow of oil and other vital products if important plants were knocked out.

Actual attack on one or two selected points, for instance, could destroy a substantial proportion of our alkylation facilities. This has been a matter of concern in the Defense Department. But this is only one of a long list of items. The department is making studies to learn how knocked-out production can most quickly be replaced from other points.

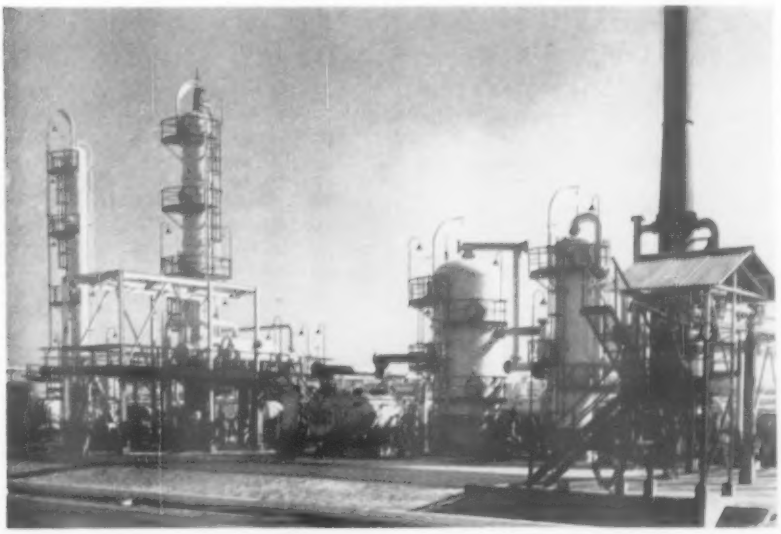
So far as the oil industry is concerned, the big factors are plant capacity, transportation, and storage. These are being evaluated from both the military and civilian standpoint, the latter from the angles of protection, rehabilitation, and manpower.

Shale-Oil Funds Asked

WASHINGTON.—Congress has been asked to give the Bureau of Mines $1,250,000 to continue work on oil shale at Rifle, Colo.

Interior Secretary Douglas McKay planned to close the Rifle plant June 30. It still is to be closed, but the bureau wants to complete certain projects. It also wants to find out, if possible, why the roof of the shale mine recently collapsed.

The Bureau of Land Management also wants more money. It needs an additional $250,000 to handle the increasing workload of uranium applications and a "great upsurge" of filings for oil and gas leases.



Air-Pollution Control Pays Off

This sulfur plant at Union Oil Co.'s new Santa Maria refinery was installed principally as an air-pollution control measure. The unit extracts 42 tons of sulfur daily from plant gases which then are used in the refinery as fuel. The refinery was built to convert heavy crude in the area into feed stocks for other Union refineries. Primary distillation takes off straight-run gasoline and gas oil. The heavy ends are coked, with the overhead stream going to a fractionator. All light fractions then are moved by pipeline or tanker to other Union refineries for further processing (The Oil and Gas Journal, April 11, page 76).

Ship Building Down

Postwar boom fading; U.S. shipyards are hardest hit

WASHINGTON.—The great postwar boom in ship construction is ebbing.

New orders for ocean-going merchant vessels have shown a sharp decline throughout the world during the past 2½ years, the American Merchant Marine Institute reported last week. American shipyards have felt the drop more than any other major maritime country with only three orders placed for private accounts during 1954 and four so far this year.

The postwar peak in world shipbuilding came in 1952 with 22,146,000 deadweight tons on order. Today vessels on order or building total 14,929,000 tons.

Tankers make up the largest proportion of the tonnage now on order. Over 8,000,000 deadweight tons, or almost 54 per cent of the total, are in this class.

The world's tanker fleet has shown the most significant change in the postwar period, the AMMI said. In January of this year it totaled 37,600,000 deadweight tons. That was more than double the tanker tonnage before World War II. When vessels now on order are built, the world tanker fleet will run over 45,600,000 tons, or almost three times the tonnage in 1939.

Almost half of the world's tanker construction has been ordered by two nations. Norway has ordered 25.5 per cent and the United Kingdom 24 per cent. In contrast, the United States with 17.6 per cent of the world's tanker fleet is only building 1.5 per cent, the institute reported.

Manpower Study Planned

WASHINGTON. — W. W. Vandeveer of the Vanson Production Corp., Cleveland, will head a 15-man National Petroleum Council committee to study manpower in the oil and gas industry for the Interior Department.

The survey was asked by the Office of Oil and Gas to bring up-to-date an earlier report by the NPC. The study will cover manpower requirements as of this July in all segments of the oil industry except retail marketing. NPC Chairman Walter S. Hal-

lanan said. In addition, the council for the first time will survey manpower requirements for production, gathering, and interstate transportation of natural gas.

Services Let Huge Orders

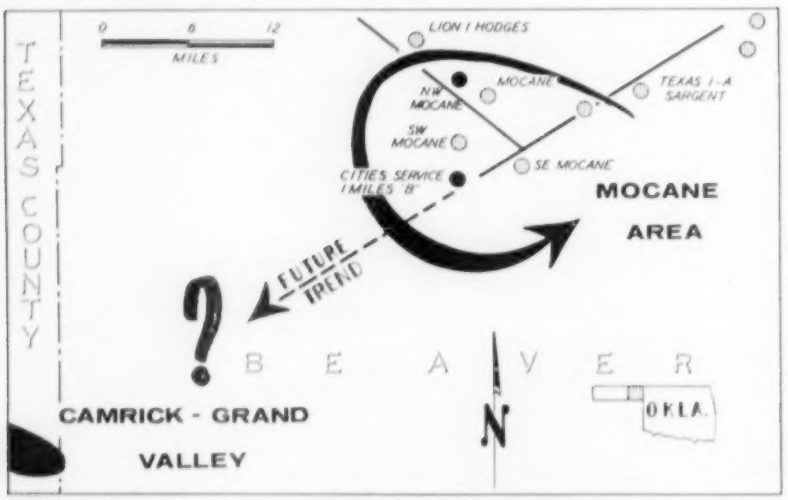
WASHINGTON.—The Armed Services Petroleum Purchasing Agency has let contracts for 9,700,000 bbl. of Navy special fuel oil costing $21,719,000 and 3,325,000 bbl. of diesel fuel at a price of $12,546,943.

Fuel oil contracts were let to Esso Export Corp., 6,350,000 bbl. for $14,795,500; General Petrolum Corp., 950,000 bbl. for $2,483,500; and Union Oil Co. of California, 2,400,000 bbl. for $4,440,000.

Diesel fuel was bought from Hancock Oil Co., 175,000 bbl. for $717,360; General Petroleum, 595,000 bbl. for $2,426,550; Tide Water Associated Oil Co., 525,000 bbl. for $2,098,372; Union Oil Co., 400,000 bbl. for $1,566,600; Delhi-Taylor Oil Corp., 480,000 bbl. for $1,711,836; Esso Export, 310,000 bbl. for $1,090,425; and Cities Service Oil Co., 840,000 bbl. for $2,935,800.

The agency also contracted for another 1,500,000 bbl. of Navy special fuel oil at prices ranging from $1.97 to $2.33 with the higher prices prevailing on the East Coast. Sharing these contracts were Richfield Oil Corp., 400,000 bbl. at $1.97; Douglas Oil Co. of California, 500,000 bbl. at $1.98; and Sinclair Refining Co., 600,000 bbl. at $2.33.

MID-CONTINENT



New strikes, big untested area mean . . .

. . . Boom in Beaver County

TULSA. — Geologists think Beaver County in the Oklahoma Panhandle will emerge soon as a major oil and gas-distillate producing area of the important Hugoton embayment.

Even the promising developments in the northeastern section of the county may be overshadowed, many believe, when tests are begun in the sparsely tested southwestern area. This wildcat territory, they figure, could well be linked with the rich Camrick-Grand Valley pool in southeastern Texas County and develop a southwest-northeast trend the full length of Beaver County.

Some operators low-rate the county. They claim production is too small and uncertain and that future prospects for growth are none too good.

But others who have investments in the area contend the Beaver County fields are economically attractive and may even become better. They point out that at least six productive sands have been found, that drilling costs are not too stiff, and that payoff in the unprorated northeastern wells is about two or three times the investment.

Payoff good . . . These same geologists say that if the Camrick-Grand Valley pool is found to extend into southwestern Beaver County, the payoff should be much better. Payoff in Camrick field has been nine times the investment.

Beaver County activity in little less than 2 years has attracted such important operators as The Texas Co., Pure Oil Co., Cabot Carbon Co., Cities Service Oil Co., Sinclair Oil & Gas Co., United Products Co., American Gas Products Co., and Lion Oil Corp. Many small independents also are active in the county.

There are 17 wells drilling in the county. Fourteen are rated potential discoveries either of new pay formations or extensions of present fields. Drilling in the past 1½ years has opened new fields in a 100-square mile area around Mocane and so far this year nine new fields or extensions have been opened.

Beaver County activity was launched with discovery along a northeast-southwest trend of three one-well gas fields in 1952 and early 1953. Pure Oil Co.'s 1 M. J. Albert flowed 2,120 M.c.f. of gas per day with distillate spray from Morrow perforations at 6,015-38 ft. This opened the Northwest Knowles field.

Sinclair discovered Southwest Mocane field with its 1 Pearl Maple, which flowed 857 M.c.f. of gas daily from Morrow at 6,495-6,548 ft.

Future trend southwest? . . . In early 1953, J. Tom Grimmett, et al 1 Hennigh was completed as a discovery for the Southeast Glenwood field, flowing 1,040 M.c.f. of gas and ⅜ bbl. of distillate per day from Morrow and Chester sands.

Activity really boomed, however, with discovery in May 1954, of Texaco 1-A Barby. It opened the Southeast Mocane field with production gaged at 6,000 M.c.f. daily from the Morrow. United Producing added a 2-mile northeast extension with its 1 Barby, flowing 15,300 M.c.f. of gas daily and 48 bbl. of distillate from the Morrow. Other developments have extended the field north, east, south and west from these two with a Mississippian gas pay added in several tests.

Production then suddenly moved northwest when United Producing opened Mocane field with 1 E. E. Evans. It flowed 20,000 M.c.f. of gas and 280 bbl. of distillate per day from the Chester formation at 6,894-6,924 ft. The 2 Evans was good for 4,400 M.c.f. from the Morrow.

Opening of Northwest Mocane field was the big discovery of 1955. Cabot Carbon's 1 Hodges, the discovery well, flowed 400 bbl. of oil per day on ¼-in. choke from Checkerboard - Pennsylvanian lime perforations. A north offset opened an entirely new pay in the Oklahoma Panhandle when it flowed 192 bbl. of oil daily through 14/64-in.

choke from Kansas City lime at 4,787-92. So far six pay zones have been indicated in this field with production established from three. Operators have yet to complete a producer in the Council Grove, Toronto, and Chester gas pays indicated by first wells in the field.

Other wells established further the southwest-northeast trend. O. H. Parker opened the South Glenwood area. The Texas Co. hit further southwest with another Morrow gas discovery. Cities Service added a Marmaton oil producer at the southwestern tip of the trend.

Geologists think the future trend will be southwest to link with the Camrick in Texas County. They doubt that the present northwest trend will extend into the southeastern section of the county where the Morrow is not believed too productive and formations are much deeper.

Champlin Refinery Expanding

ENID, Okla.—Champlin Refining Co. has placed on stream a $1,000,000 Platformer at its refinery here.

The new unit, built by Southwest Engineering Co., Los Angeles, will upgrade about 5,000 bbl. of 225° to 400° F. naphtha daily to high-octane gasoline-blending stock.

The Platformer is the first unit completed under Champlin's $4,000,000 modernization program at Enid. Construction of a 9,000-bbl. fluid catalytic cracking unit is being pushed and should be completed by late summer. The cracker is a Model B Orthoflow unit. M. W. Kellogg Co. is building the unit.

Champlin also is spending $300,000 on an addition to the refinery's polymerization unit. This work also should be completed this summer. New offices and a laboratory also are being built.

The Enid refinery, rated at 22,000 bbl. per day, is one of two acquired by Chicago Corp. a little more than 1 year ago when it bought out Champlin. The other plant is a 2,500-bbl. refinery at Oklahoma City. This refinery, formerly operated by Peppers Refining Co. is shut down.

Expansion of the Enid refinery is just one phase of Chicago Corp.'s plans to deepen its niche as an integrated oil firm.

From solely a producing firm, the company became an oil-products manufacturer, pipeliner, and marketer with its acquisition of Champlin. It is expanding its pipelining and marketing activities along with its refining.

Chicago Corp. has started construction of a new 50-mile, 15,000-bbl. products line from Enid to Ponca City. Cost is estimated at $500,000.

The company recently completed a 70-mile products line from Enid to Oklahoma City. The two new lines will supplement a 516-mile, 6-in. products line from Enid to Rock Rapids, Iowa, already in operation when the Champlin deal was made last year.

THIS 5,000-BBL. PLATFORMER represents the first step in Champlin Refining Co.'s current expansion and modernization program at its Enid, Okla., refinery. Shown in the picture are Jack Wilson, Jr., left, and Eugene R. Andrew, right.

Refining Briefs

BALTIMORE.—Esso Standard Oil Co. has completed a new 3,000-bbl. per day fixed bed Hydroforming unit using platinum-type catalyst at its refinery here. Two Hydrofiners with a total capacity of 17,000 bbl. daily also have been completed. The units will be placed on stream as soon as the fluid catalytic cracking unit is brought into operation following an expansion from 36,000 to 60,000 bbl. daily. Esso's new 10,000-bbl. fluid coker will be brought into operation in mid-July.

WILMINGTON, Del.—Ethyl Corp. has introduced an improved Ethyl antiknock compound called motor plus. The new tetraethyl lead blend contains new proportions of chemical scavenging agents which will reduce engine deposits. By cutting preignition and octane requirements buildup in engines, the new blend will lower engine octane requirements by as much as one octane number. Motor plus will sell for 59.69 cents per pound of TEL content.

EL SEGUNDO, Calif.—A big oval balloon soon will fly over the Standard Oil Co. of California refinery here. It will hold specially designed instruments which continually will analyze the atmosphere above the big refinery to assure no pollutants are being released.

SARNIA, Ont.—Imperial Oil, Ltd., is road testing a fleet of 19 new automobiles of identical make and model to evaluate fuels and lubricants. The first such tests ever undertaken in Canada are being made near here. Both city and country driving will be included. Each car will be torn down and exact wear measurements made twice during the 15,000-mile test.

NEW YORK.—The American Petroleum Institute is distributing a new pamphlet of vapor-pressure charts. They were developed recently by Esso Research & Engineering Co. and made available to the A.P.I. The new charts are based on correlations which were critically examined by a special A.P.I. committee and judged superior to those already published. They can be used as standards for specification and control purposes in production, refining, and sales.

NEWARK, N. J.—Baker & Co. has signed an agreement to furnish Sinclair-Baker platinum catalyst to Socony Mobil Oil Co., Inc., for a group of Sovaforming units planned in the United States and abroad. Two Sovaformers are now on stream and catalyst has been ordered for six more.

Tax Issue Near End

Texans may learn this week what the next 2 years will hold in the way of taxes affecting the oil industry

Robert J. Enright

AUSTIN.—How the oil and gas industry will fare tax-wise in Texas during the next 2 years may finally become known early this week.

The senate managed after a long, hectic struggle to hammer out a tax bill May 27 which would bring in more than $100,000,000 in new revenue over a 2-year period.

The house, which watched the senate work over substantially the former's version of what new taxes ought to be, refused to accept the senate bill as it stood and sent the two bills to a conference committee June 1.

It was believed that the conference committee might work out a compromise which would end the biggest and most confused tax squabble Texas has seen in years.

What's involved . . . The senate and house bills each provide a 1-cent boost in the state gasoline sales tax to 5 cents a gallon.

There was only one other provision in the house bill and two in the senate bill which affect the industry directly.

The house measure called for making permanent an 8 per cent production tax on natural gas at the wellhead. This would rescind a law which would drop the tax to 7 per cent in September 1956.

The senate threw out this provision but included another calling for a token on natural gas dedicated to transmission lines under long-term contracts. The dedication tax, fixed at one-twentieth of 1 cent per M.c.f., was designed to draw gas pipelines into testing its constitutionality in court.

If the tax should stand up under suit, the state then could increase the tax to meet future revenue needs without fear of a repetition of its unfortunate experience of last year. The U.S. Supreme Court in February last year declared unconstitutional the state's first effort to tax the long lines, thereby plunging the legislature into a desperate financial hole.

Almost 3 years had been spent in fighting the tax through the courts when the high court made its final decision, and Texas was deprived of roughly $30,000,000 it had already collected. Gov. Allan Shivers was forced to call a special session of the legislature to replace the loss in state funds.

The senate last week also called for applying the state's intangible tax law to the gas lines. This would bring in about $250,000 annually. It was pointed out in the house, however, that the senate had overlooked something in that a gas line called upon to pay a tax on intangibles would be required by an existing law to pay only about one-fifth of its present franchise tax. This oversight would actually cost the state about $4,000,000 annually instead of increasing revenue.

The outlook . . . Few are predicting what the conference committee may do in reconciling the two bills. Some think it likely that both gas-tax provisions will be thrown out and that the gasoline sales tax increase will be upped 1½ cents instead of the present 1 cent a gallon. Governor Shivers is on record as favoring a 2-cent hike but has had little luck in lining up legislative support.

Another conference committee is busy trying to iron out differences between senate and house bills which would require oil operators to post bonds to assure plugging of abandoned wells to prevent pollution of freshwater strata. Passage of this bill is virtually assured in one form or another.

The house has concurred with senate amendments to a bill requiring that cans of reconditioned motor oil be plainly labeled as such. The bill has been sent to the governor.

Texas Lake May Be Leased

LONGVIEW, Tex.—Texas fishermen may soon be navigating around drilling rigs in Caddo Lake northeast of here on the Texas-Louisiana state line.

Gov. Allan Shivers last week signed into law a bill permitting the Texas

New Machine Gives Lowdown on Gasoline Quality

This new demonstration engine that will give an accurate answer on almost any performance quality of a gasoline. Developed by the Du Pont Co.'s Petroleum Chemicals division, it will find use in showing how high octane numbers can suppress preignition effects and in measuring volatility and antiknock difference between regular and premium gasoline. The single-cylinder unit has a modern combustion chamber and a compression ratio of 9 to 1, making it comparable with late-model automobile engines. It is portable and easy set up to make it valuable for gasoline marketers to demonstrate fuel quality before small or large groups. It will be available at the company's regional offices at Los Angeles, Chicago, Tulsa, Houston, and New York.

School Land Board to lease the Texas portion of the lake and state lands around it for oil and gas development.

The state's oil operators are expected to snap up the leases. Prolific production already has been developed on the Louisiana portion of the lake.

Caddo is one of the biggest freshwater lakes in Texas. The portion on the Texas side alone takes in about 40,000 acres. Depth of water hasn't deterred development on the Louisiana side. At least one large barge as big as most of those operating off the Texas and Louisiana gulf coasts has been drilling in the lake for some time.

Flood Authorized

Tennessee Gas to operate big project in West Texas

AUSTIN.—Tennessee Gas Transmission Co. will conduct a full-scale water flood of the prolific Grayburg horizon in World field of West Texas.

The company got the green light for the project last week from the Texas Railroad Commission.

World field covers about 5,000 acres in north Crockett County. Its Grayburg pay has produced more than 20,850,000 bbl. of oil—more than 108,000 bbl. per well.

The full-scale flood is being launched on the basis of favorable results from a test project begun last November 15. The company injected via gravity flow about 1,000 bbl. of water daily through its No. 10 well. Daily production of offsetting wells was hiked an average of about 30 bbl. each.

Production in the field began a sharp decline in 1953 and dropped 16 per cent in 1954. Present per-well average is about 17 bbl. Tennessee Gas predicted that this would drop to 3 bbl. per well in 10 years if pressure maintenance were not started.

Ultimate additional oil recovery due to the flood was not estimated.

Lopez project . . . Pressure trouble in another quarter was reported to the commission by Jake L. Hamon.

Hamon and other operators asked the commission to approve a unit and water flood in the first Mirando sand of Lopez field in Duval County, South Texas, to counter a drop in pressure.

Production in the field, the commission was told, is approaching the uneconomic level via primary operations. Estimates were that about 1,500,000 bbl. more oil could be recovered if unitized pressure maintenance is undertaken.

Lopez field, discovered in 1935, takes in 3,544 acres of which 675 would be affected by water injection. There are 244 wells in the pool producing from about 2,150 ft.

Operators plan to inject about 15,000 bbl. of water a day into the Mirando at a pressure of about 500 psi. on a modified five-spot plan.

The planned unit includes an unusual arrangement whereby the unit is considered one for operational purposes but is divided into east and west units for royalty purposes.

The commission heard that 100 per cent of working interests and 94 per cent of royalty interests have approved the unit.

Navy Land to Be Leased

WASHINGTON.—Oil and gas leases on 1,603 acres of Texas lands will be sold by the Bureau of Land Management on bids to be opened July 6.

The bureau is offering five leases ranging from 313 to 340 acres each. They are in the Camp Wallace Military Reservation in Galveston County.

The reservation is owned by the Navy, which turned the oil and gas deposits over to the Interior Department for development to prevent drainage losses from privately owned wells on adjacent lands.

Refinery Workers Moving

FORT WORTH.—Magnolia Petroleum Co. is moving 105 of its 200 employes in the shutdown Fort Worth refinery to the company's big refinery at Beaumont.

Magnolia said all but 21 employes at Fort Worth were offered jobs at Beaumont or were given accelerated retirement. The 21, newer employes, received a termination allowance based on length of service.

The mass move to Beaumont, including employe families, will involve 350 people. The Fort Worth refinery, which went on stream in 1914, had a crude capacity of 8,500 bbl. The Beaumont refinery has a capacity of about 180,000 bbl. daily.

CANADA

Westcoast Signs Contracts

CALGARY. — Westcoast Transmission Co., which proposes delivery of natural gas from the Peace River fields for distributors in British Columbia and the Pacific Northwest states, has completed contracts with 11 producers guaranteeing initial supply.

Under terms of the contracts, the companies will sell Westcoast 355 million cubic feet of gas daily over a 20-year period.

Of the total, 250 million cubic feet daily will be supplied by Pacific Petroleums, Ltd., and Peace River Natural Gas Co., Ltd.

Other suppliers will include Imperial Oil, Ltd.; Royalite Oil Co., Ltd.; Canadian Fina Oil Co., Ltd.; Gulf States Oil Co. of Canada; J. B. White; A. M. Lloyd; Fargo Oils, Ltd., and associates; Pathfinder Petroleums, Ltd.; Shell Oil Co.; and British American Oil Co.

Alberta Gas Line Sought

MEDICINE HAT, Alta.—South Alberta Pipe Lines, Ltd., has filed application for a permit to construct a 150-mile, 8-in. pipeline to carry natural gas from the Etzikom field to serve the nitro-chemical fertilizer plant to be built near here by Commercial Solvents Corp., New York.

The request will be heard June 7 by the Alberta Petroleum and Natural Gas Conservation Board. It will cost about $1,000,000 and will serve the town of Medicine Hat as well as the new plant.

The $22,000,000 fertilizer plant is to be built this summer by Ford, Bacon & Davis, New York.

South Alberta would operate the pipeline for New British Dominion Oil Co. and Mid-Con Oil & Gas, Ltd., which will supply natural gas to the new plant.

Canadian Briefs

VANCOUVER.—This area may be served with natural gas next year even if Westcoast Transmission's proposed pipeline is not completed from the Peace River area until 1957. Officials of B. C. Electric Co. announced they are investigating plans to bring in gas from the United States as a temporary measure until Alberta gas is available.

OTTAWA.—Canada's Senate banking committee has approved a bill incorporating Trans-Border Pipeline Co. with $5 million capital, to build a 110-mile oil pipeline from Skagway, Alaska, to Whitehorse, Y. T. The bill now must clear the Senate and the lower House before becoming law.

CALGARY.—Canadian Gulf Oil Co. officials are surveying the Stettler-Big Valley area to determine whether to build a natural-gasoline plant to serve gas fields there.

Industrial "reodorants" can end

. . . Refinery Odor Problems

F. Lawrence Resen

BIG SPRING, Tex.—Want to win friends and influence pollution-control boards? You may be able to do so merely by using industrial "reodorants" to counteract offensive smells coming from your refinery.

Reodorants are like chlorophyll: Add them in the proper places and they'll sweeten stack gases, flare gases, and waste waters.

They'll even go a step further and improve petroleum products, according to C. H. Nichols, Rhodia, Inc., New York. He discussed reodorants at the Western Petroleum Refiners Association regional meeting here.

What are they? . . . Industrial reodorants are peculiar chemicals which superimpose one characteristic odor upon another. The effect is to cancel out an obnoxious odor without affecting the manufacturing process or hurting product quality. They are prepared from a wide variety of chemicals such as ketones, esters, aldehydes, and synthetic-aromatic chemicals. They may be tailored for individual uses.

Thus, in a refinery process in which mercaptanes, disulfides, hydrogen sulfides, or aldehydes are present, a specific odorant may mask a specific malodorous compound, Nichols said.

On the practical side, these chemicals present a simple, low-cost method to ease air pollution. Just by using reodorants, some refiners have escaped court injunctions and lawsuits which threatened the shutdown of certain operations, Nichols said.

In one case in which an injunction was threatened, the chemicals were added by means of a steam injector into one of the pilot lines running to a flare. What normally was the ignition line was used strictly for introduction of the reodorants. Result: flare gas sweetened; injunction dropped.

Before trying these masking agents, a refiner should make a thorough engineering study of his particular plant.

The agent selected must not only neutralize the bad odor; it also must meet specific requirements of the individual processing unit. Such characteristics as lasting power, intensity, volatility, boiling points, specific gravity, compatibility, and flash point may help.

Nichols pointed to specific methods used to abate air pollution at plants producing various products.

Asphalt . . . Acidic operations produce gases with an obnoxious smell. Steam injection of the reodorant directly into the stack is one solution. The agent also may be added with a dispersible product into a scrubbing operation of the fume waste.

Light oils . . . In treating light-oil streams by caustic scrubbing, the regeneration kettles sometimes give off strong odors. These smells may be masked by steam injection of the proper agent into the stacks of the kettles.

Lube oil . . . Acid sludge from treating operations is sometimes hydrolyzed by open steam before going to the furnace as fuel. Odors from the kettles go right into the atmosphere. Chemical reodorants can control the smell if they are added directly to the acid sludge prior to cooking with steam.

Cutting oils . . . The process involves mixing of heated sulfurized mineral and lard oils in an agitated kettle. Again, reodorants can be added directly into the vessel, particularly in the latter phase.

Other applications include the injection of reodorants into boiler stacks, treating barometric condenser water, and masking of waste waters leaving A.P.I. separators.

Product quality . . . While concentrating on pollution control, a refiner can't ignore improvement of quality in his products, Nichols said. Process operations to correct product odors should always be made. If these fail or prove uneconomical, masking agents may be used as a substitute.

It's possible to treat No. 1 and 2 fuel oils, cutting oils, and coal-spray oils for 1 to 2 cents per barrel. This can be done with little or no capital investment. Lab tests have given good results in using the chemicals with mineral-type solvents, diesel oils, kerosine, and gasoline fractions.

The use of reodorants, then, not only can improve relations with the air-pollution agency; it also can improve product quality and even sales, Nichols concluded.

New Giant Rises in Manhattan

Circled in the center of this photograph is the new office building being built for Socony Mobil Oil Co. in midtown New York City. The view is to the northwest with the Chrysler Building directly behind the new structure. The $45,000,000, 42-story building, to be sheathed in stainless steel, is the largest to be built in New York since the 1920's. Socony Mobil's 2,300 New York employes will occupy about 40 per cent of the total space. The company is now headquartered in the 70-year-old original Standard Oil Co. building at 26 Broadway in lower Manhattan. It is due to move into its new quarters in May 1956.

Sinclair Union Polled

Workers' opinions asked on firm's plan to end deadlock

NEW YORK.—The C. I. O. Oil, Chemical and Atomic Workers International Union was polling its Sinclair Oil Corp. locals last week to get workers' views on the company's latest proposals to end a contract deadlock.

Details of the proposals were not disclosed. They were advanced by Sinclair at negotiation sessions with an O.C.A.W. bargaining team which began here May 26, about 6 weeks after the union terminated the Sinclair contract. Negotiators for both sides agreed to stand by pending the check of locals.

B. J. Schaefer, union vice president and coordinator of the Sinclair council, emphasized the workers were not voting on acceptance or rejection of the Sinclair proposals. Only their opinions on the offer were being solicited, Schaefer said.

Presumably, Sinclair offered improvements in grievance procedure and further safeguards to awarding of work contracts to outsiders. These were the two points which blocked final contract agreement after both sides earlier had agreed to a 10-cent an hour across-the-board wage increase, as well as to improved sick benefits and group life-insurance programs.

The Sinclair contract is the only nationwide contract in the oil industry.

New Crude Supply Is Handy

This wildcat recently was completed by Pan-Am Southern Corp. just a few hundred feet from the company's 34,500-bbl. refinery at El Dorado, Ark. The well, R. W. Burnett Pan-Am Fee No. 3, was drilled on a 60-acre tract which the company had tried to buy 20 years ago to provide room for expansion of the refinery. The land purchase was not completed until early last year. This well, which followed two dry holes, was drilled to 3,813 ft. It produces the allowable of 100 bbl. per day of 38°-gravity crude, which is piped to the refinery shown in the background. The company plans more drilling on the tract.

Octanes Edge Up in May

NEW YORK. — Octane ratings of premium gasoline moved up to an average of 95.3 in May and regular jumped to 88, according to the latest monthly survey conducted by Ethyl Corp.

These weighted averages for the nation represent gains of 0.1 octane number in premium and 0.3 in regular within a month. Tetraethyl lead content averaged 2.57 and 2.25 ml. per gallon, a slight increase over the previous month, but essentially the same as a year ago.

The current Ethyl survey also shows vapor pressure and distillation temperature for gasoline samples collected from 53 marketing centers over the U.S. This volatility survey is conducted quarterly.

The detailed report showed premium octane ratings averaging 96.0 or more in 18 cities, with Birmingham, Ala., the highest at 96.7. Regular averaged 90.0 octane or better in five cities, Baltimore, Md., being the highest with 90.4.

Of the 53 marketing centers surveyed, 29 showed increases in premium octane over April. Of these, 12 jumped a half octane number or more. A total of 36 raised regular octane ratings in May, with 24 reporting gains of a half octane number or more.

Standard Offers Drill Sites

LOS ANGELES.—Shortage of drill sites from which wells can be slanted underneath the tidelands will not be a deterrent to bidding on the 320-acre parcel offshore from Huntington Beach. Bids will be opened June 8.

Standard Oil Co. of California would be in a preferred position since it holds leases adjacent to the parcel offered. However, two lessors, Pacific Electric Railway Co. and Huntington Beach Co., have announced that Standard had consented to make the drill sites available to all.

Big Block of Toklan Sold

DALLAS.—Clint W. Murchison and three others paid roughly $1,700,000 for a large block of stock in Toklan Oil Corp., Tulsa, from Curtis F. Bryan, Toklan president, and associates.

The buying group included Cecil V. Hagan of Houston, Roy B. Kelly of Washington, and G. L. Ohrstrom & Co. of New York, in addition to Murchison.

It paid $7 a share for about 245,000 of Toklan's total 872,585 shares.

Toklan holds working interests in 193 wells and royalty interests on producing and nonproducing properties in Oklahoma, Texas, Kansas, and Illinois. The company's net daily oil production is about 1,200 bbl.

Bryan is expected to step down as president of the company, but no other changes in personnel are planned. Offices of company will remain in Tulsa.

Pipeline Contract Let

LOS ANGELES.—Contract has been let for construction of another section of the products pipelines which Southern Pacific Pipe Line, Inc., is building between Los Angeles and El Paso. R. A. Conyes Construction Co., San Pablo, Calif., was awarded contract for the 200-mile section of 12-in. line between Colton, Calif., and Yuma, Ariz.

Contracts for the remaining portion of the Los Angeles-Phoenix line are to be announced soon by Management Engineers, Inc., the Bechtel Corp. subsidiary in charge of engineering and constructing the line. That for the Tucson-Phoenix 10-in. line also is to be let soon.

Morrison-Knudson Co., Inc., Los Angeles, and River Construction Co., Fort Worth, will lay the approximately 180-mile section of 8-in. line from El Paso to Lordsburg, N. M. The remaining 150 miles into Tucson will be laid by R. H. Fulton & Co., Lubbock, Tex.

Drilling Spree Forecast

Natural-gas pipelines in Rockies will encourage more exploration and development, A.I.M.E. sections told

DENVER.—Completion of major new natural-gas pipelines in the Rocky Mountain area by Pacific Northwest Pipe Line Corp. and Colorado Interstate Gas Co. will offer an incentive for further exploration and development in the mountain states.

This is assured by the fact that the projects already have become the basis for much of the recent exploration activity in the region, S. Cassell Barrett, vice president of Colorado Interstate, told 300 delegates attending the first annual meeting of the Rocky Mountain Petroleum Sections, American Institute of Mining and Metallurgical Engineers.

Last year 1,012 wildcats were drilled in Colorado, Utah, and Wyoming, he said, and about 15 per cent of them were producers. Of the producers, 44 were gas wells and 121 were oil producers, he said.

DELEGATES to first meeting of Rocky Mountain Sections, A.I.M.E., were welcomed by R. W. French, right, vice president and general manager of Sohio Petroleum Co. Also shown is R. L. Hoss, Vaughey & Vaughey, Denver, chairman of the meeting.

Reserves increase . . . Barrett pointed out that gas reserves in the three-state area have increased impressively in the past 2 years.

"In January 1953," he said, "The U.S. Bureau of Mines reported total proven reserves of 3.8 trillion cubic feet for Wyoming, Colorado, and Utah. By January 1, 1955, this figure had increased to 5.2 trillion cubic feet."

Pacific Northwest has begun construction of a 1,466-mile pipeline from the Colorado-New Mexico San Juan basin to the northwest section of the United States. Westcoast Transmission Co., Ltd., will carry gas from southwestern Canadian fields to the Pacific Northwest line, and El Paso Natural Gas Co., is planning a spur line from the Pacific Northwest line at a point near Mountain Home, Idaho, to the California border.

Colorado Interstate's link in the vast network will be a 380-mile pipeline from a point near Rock Springs, Wyo., to Denver.

Big market . . . The pipeline projects of Pacific Northwest and Colorado Interstate will lead to "practically an unlimited market outlet" for Rocky Mountain natural-gas production, Barrett said.

He cautioned production-company personnel, however, that regular pipeline operations dictate important basic factors in gas purchase contracts. These include a long primary term of at least 20 years, a price commensurate with the quantity of reserves available for sale, the rate at which they will be produced, and the transportation facilities needed for their marketing.

"You should not expect us to spend large amounts for pipelines to connect short-term gas supply," he emphasized.

Gas drilling . . . Development of the San Juan basin has proved the value of air and gas drilling, according to C. L. Moore and V. A. LaFave, of El Paso Natural Gas Co.

They estimated that between 800 and 1,000 wells have been drilled with gas in the area. Development of production from the Mesaverde formation there would have been impossible without gas drilling, they contended.

"Drilling mud completely blocked the producing formation," the authors noted, "and the only alternative prior to gas drilling had been cable-tool operations. It would often take 5 to 8 weeks to drill the 800-ft. Mesaverde section."

Cable-tool operations were hazardous, and fishing jobs were frequent.

"Mesaverde wells can now be drilled, surveyed, shot with nitroglycerin or sand-oil fractured, cleaned out, and tubed in a matter of 4 to 10 days using gas as a circulating fluid," they said.

Air drilling . . . Moore and LaFave said that the San Juan basin gave the industry its first practical application for air drilling. Compressed air has been widely used in drilling wildcats where gas was not available.

Use of air, according to the El Paso Natural engineers, has increased drilling rates, lengthened bit life, and helped prevent lost circulation. It also has cut down the possibility of passing up a productive zone during drilling operations.

"Even if drilling costs were the same, or even higher, it would often be advantageous to use air because of this reason," they said. "Air drilling has outgrown its infancy and has been adapted to virtually every drilling and completion technique."

They urged rigid training and supervision of rig crews to prevent carelessness, which was described as "the greatest potential danger" in air drilling.

Injection Planned

Tri-Co. moving gasoline plant to Clareton field

NEWCASTLE, Wyo.—A pilot repressuring program in Clareton field will be undertaken jointly this fall by three oil companies.

Tri-Co. Gas Co., jointly owned by Voss Oil Co., Wyton Oil & Gas Co., and Rosebud Oils, Inc., has bought a 5,000,000-cu. ft. gasoline plant which it will move into the field to handle gas from one area. Dry gas will be returned to the reservoir.

Many wells with a gas-oil ratio of 5,000 to 1 or greater have been shut in recently as a conservation measure. High-ratio wells will be permitted to produce if the stripped gas is reinjected.

The gasoline plant, which has been operating in Sporn field, near Cushing, Okla., will be torn down and moved this summer to Clareton field. It is expected to begin operations there in September.

A Voss Oil Co. official said a larger gasoline plant may be installed in the field if the pilot operation proves successful.

Plans are now being considered by a committee of producers for construction of one or more plants to handle gas now being flared in the field *(The Oil and Gas Journal, May 30, page 62)*.

Explorations in 7 Areas Make . . .

. . . Colorado's Oil Outlook Bright

DENVER.—Seven areas in Colorado have good possibilities for discovery of new oil and gas reserves, according to Raymond D. Sloan, western division manager of Carter Oil Co.

What's more, Sloan predicted, proven crude-oil reserves in Colorado will increase from the present 328,651,000 bbl.—eleventh in the nation—to 500,000,000 bbl. in the next 10 years. He also forecast a production increase from the current 140,000 bbl. daily.

Speaking at a recent press dinner here, Sloan said three factors control discovery of oil—volume of exploratory effort, availability of territory, and exploratory methods. There is plenty of available territory in Colorado and exploratory methods are modern, he noted.

Therefore, Sloan declared, oil discoveries in the state will depend on the volume of exploratory effort. Economic factors must be favorable for oil companies to risk capital when one oil discovery is made for every nine wildcat wells drilled, he said. A favorable tax structure and the availability of markets are two of the most important economic factors.

The Carter official listed these portions of Colorado where oil prospects are considered good:

. . . **Baca and Prowers counties** in the southeast, where the Greenwood gas field has extended across the Kansas line into Colorado.

. . . **Eastern Denver basin,** where daily average production has increased from 253 bbl. 6 years ago to more than 62,000 bbl.—second only to the leading Rangely field in the northwest.

. . . **Western rim** of the Denver basin, where recent drilling has resulted in encouraging shows in the area west and southwest of Denver.

. . . **North, South and Middle Parks areas,** west of Denver. A recent 700-bbl. discovery in North Park has given impetus to this section. The geology of all three areas is similar.

. . . **Piceance and Washakie** areas of northwestern Colorado, including Rangely.

. . . **Grand Valley district** west of Grand Junction, where Carter will drill several wildcats in the next few months.

. . . **Four Corners section** in extreme southwestern Colorado, where the Pacific Northwest pipeline will be important to the discovery of oil. It will provide an outlet for whatever gas drillers may discover while seeking oil, Sloan said.

The Pacific Northwest gas outlet also is expected to stir drilling activities in Grand Valley.

Carter also plans several wildcat wells in southeastern Utah this summer, Sloan said. Carter drilled three dry holes there last summer on land near Shell Oil Co.'s two Utah discoveries.

Colorado Has Gas Strike

LAS ANIMAS, Colo.—Pennsylvanian gas production has been established at the Las Animas arch of southeastern Colorado, 10 miles northeast of here.

M. J. Stansbury of Bakersfield recovered gas at the rate of 2,000 M.c.f. per day on a drill-stem test of either the Atoka or basal Des Moines at 4,625-45 ft. at the 1 Coordes & Oberlander in Bent County. A spray of oil accompanied the gas flow.

Southeastern Colorado has been quiet exploration-wise since 1952 when Continental Oil Co. made a small Morrow (Pennsylvanian) gas strike at Eads in Kiowa County. Several wildcats have been located in the region in recent weeks. El Paso Natural Gas Co. is drilling at 1 Swift in the C NE NE 6-24s-51w. The Stansbury discovery well is located in an area of no previous drilling. There are nine active wildcat locations in Las Animas County and one in Bent.

Lease Filing Tax Killed

LINCOLN, Neb. — The Nebraska Legislature has killed a proposed documentary tax on oil and gas leases at time of filing.

The move to defeat the measure was led by Sen. Don McGinley of Ogallala, who said the proposed tax would discriminate against the exploration section of the industry.

Meantime, opponents of a bill to impose a severance tax on oil and gas production failed to prevent the measure from getting approval on second reading. The vote was 27-8, or 5 votes more than the required number for passage.

Shallow Wildcats Planned

DENVER. — A series of shallow wildcats will be drilled near Morrison, 13 miles southwest of here, in an effort to develop production near oil seeps.

The tests will be drilled by Great Basins Petroleum Co. on leases held by Overland Oil, Inc., of Denver. The leases cover about 3,000 acres. Numerous oil shows have been found in the area during core-drilling operations by uranium prospectors, Overland said. The test wells, which will be started immediately, will run to 2,500 ft.

Great Basins currently is drilling a deep test near S. D. Johnson's oil discovery, 1 Little Pallaoro, in a nearby area.

Lease Sale Planned

Montana board may seek 16⅔ per cent royalty

HELENA, Mont.—The Montana Land Board at its June 8 meeting will select a date to auction oil and gas leases on state-owned lands under the controversial 1953 indefinite-term law.

Also to be determined at the meeting are the royalty terms to be demanded in the leases—an action which might pave the way for litigation on the issue.

At the board's meeting last week, two members—Atty. Gen. Arnold H. Olsen and Miss Mary Condon—served notice they will hold out for a minimum of 16⅔ per cent royalty on all but wildcat acreage. Olsen indicated he would file a lawsuit to tie up the leasing if the board agrees to lower royalty terms.

Current law provides royalty on state land shall be 12½ per cent on the first 3,000 bbl. of oil produced and a like amount on all gas production.

Leasing was halted in April 1953 after the attorney general ruled the 1953 law was unconstitutional. The decision later was reversed by the U. S. Supreme Court. The only auction held during this time was last January when a few leases were sold under the old 20-year law.

The land board has received more than 150 applications for oil and gas leases, covering nearly 69,000 acres of land. Others are certain to follow once a definite date is set.

Pipeline Section Started

GRAND JUNCTION, Colo.—An 80-man crew of R. H. Fulton & Co. last week began work on the 160-mile Moab-to-Jensen, Utah, section of Pacific Northwest Pipe Line Corp.'s natural-gas line.

Fulton is laying the 26-in. line under contract with Fish Northwest Constructors, Inc., which has charge of building the 1,466-mile line.

Associated Pipeline Contractors, Inc., Houston, Tex., also has set up headquarters in Green River, Wyo., to supervise construction of a 77.6-mile connecting section.

Production Still Rises

World output hits new high for fifth consecutive month; increases in U.S. and Middle East largely responsible

CRUDE-OIL production in the free world for March set a new all-time high record for the fifth consecutive month. Increased output in the United States and the Middle East was largely responsible.

The March average for the free world was 13,669,100 bbl. daily, up 180,300 bbl. daily over February, or an increase of 1.3 per cent. Gains during the month were tied to heavy demands for fuel oils in both the Eastern and Western Hemispheres.

U.S. production was up 51,000 bbl. daily during the month to 6,886,000 bbl. daily for another new high. Higher allowables of 24,000 bbl. daily in Texas and 10,000 bbl. daily in Louisiana accounted for most of the domestic increase.

The most marked rise in output, however, took place in the Middle East. Production in Kuwait remained at about the high level of February, averaging 1,086,700 bbl. daily. Output in Saudi Arabia also exceeded 1,000,000 bbl. daily during the month. Production there soared to 1,017,400 bbl. daily, an increase of 94,300 bbl. daily, or 10.2 per cent over the previous month. It was the highest output in the kingdom since May 1954.

Heavy output . . . A new record flow of crude was set in Iraq, where output reached 764,200 bbl. daily. The production surpassed the previous high of October by 5,900 bbl. daily. A new high of 144,000 bbl. daily was set in Basrah Petroleum Co., Ltd.'s Zubair field. This more than offset a dip in production, in comparison with October, in Iraq Petroleum Co., Ltd.'s Kirkuk field, the nation's biggest. Last October, Kirkuk's output was 516,700 bbl. daily, and in March, 491,700 bbl. daily. Zubair's production was 114,100 bbl. daily in October.

The Trans-Arabian Pipe Line Co. said that crude deliveries from Sidon, Lebanon, were up in March in comparison with last year. March shipments averaged 325,000 bbl. daily against 318,673 bbl. daily last year.

In Iran, production by consortium companies reached 297,000 bbl. daily, an increase of 34,000 bbl. daily, or 12.9 per cent over the previous month. In addition, there was small net production of 3,800 bbl. daily in Naft-i-Shah field, operated by the National Iranian Oil Co. Another 700 bbl. daily of residual was removed at a topping plant in this field and returned to the formation. Located in northeastern Iran, Naft-i-Shah production is refined at the nearby Kermanshah refinery. Products are consumed locally.

N.I.O.C. maintained a steady output in Naft-i-Shah following the nationalization of the oil industry. The figures for the last three Persian years, which run from March to March, were: 1952-53, about 4,600 bbl. daily gross and 2,500 bbl. daily net; 1953-54, about 4,500 bbl. daily gross and 2,500 bbl. daily net; and 1954-55, about 4,600 bbl. daily gross and 2,900 bbl. net.

TREND OVER THE LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total non-Communist countries
1954—			
March	2,630.4	2,767.6	5,841.7
April	2,565.1	2,642.0	5,653.1
May	2,639.3	2,766.0	5,863.8
June	2,648.5	2,685.0	5,805.5
July	2,667.0	2,758.7	5,890.9
August	2,663.7	2,749.5	5,891.9
September	2,704.5	2,702.2	5,879.2
October	2,750.0	2,898.6	6,141.6
November	2,856.5	2,844.6	6,193.6
December	2,957.7	3,001.8	6,453.3
1955—			
January	3,001.5	2,950.1	6,442.5
February	3,050.4	3,109.3	6,653.8
March	3,043.0	3,247.9	6,783.1

Egypt down, Europe up . . . Production in Egypt, Africa's most important oil country, continued to slip. Output averaged 33,300 bbl. daily, off 600 bbl. daily from February and down from 39,300 bbl. daily a year ago. The downward trend in production is expected to be reversed this year, how-

CRUDE-OIL PRODUCTION

(Daily average production in thousands of barrels)

Country—	March 1955	Feb. 1955	March 1954
Western Hemisphere:			
Argentina	87.0	85.6	83.5
Bolivia	6.5	6.5	5.0
Brazil	6.0	5.5	2.1
Canada	312.0	319.0	200.0
Chile	6.0	6.0	4.3
Colombia	106.6	103.5	113.5
Cuba	0.7	0.5	0.1
Ecuador	9.4	9.6	8.6
Mexico	250.0	250.0	229.7
Peru	47.0	47.3	48.0
Trinidad	67.0	67.1	63.6
Venezuela	2,144.8	2,149.8	1,872.0
Total	3,043.0	3,050.4	2,630.4
W. Europe and Africa:			
Algeria	1.4	1.2	1.7
France	12.3	12.1	7.3
Fr. Morocco	2.4	2.4	2.5
W. Germany	57.8	57.2	48.9
Italy	2.9	2.9	1.6
Netherlands	19.1	19.7	16.1
Egypt	33.3	33.9	39.3
United Kingdom	1.2	1.2	1.2
Total	130.4	130.6	118.6
Middle East:			
Bahrain	30.0	30.1	30.1
Iran	300.8	266.8	45.0
Iraq	674.2	662.6	595.8
Kuwait	1,086.7	1,086.6	1,012.2
Neutral Zone	24.0	24.0	6.9
Qatar	112.2	113.5	98.8
Saudi Arabia	1,017.4	923.1	978.3
Turkey	2.6	2.6	0.5
Total	3,247.9	3,109.3	2,767.6
Other Asia:			
Brit. Borneo	99.0	99.0	99.0
Burma	3.7	3.7	3.5
India	7.0	7.0	6.8
Indonesia	230.0	230.0	196.3
Japan	6.0	6.7	5.9
New Guinea	10.8	11.8	8.4
Pakistan	5.3	5.3	5.2
Total	361.8	363.5	325.1
Total non-Communist foreign	6,783.1	6,653.8	5,841.7
United States	6,886.0	6,835.0	6,506.5
Total, Free World	13,669.1	13,488.8	12,348.2
Communist-controlled countries:			
Russian occupied zone of Austria	57.5	57.5	62.0
Romania	125.0	125.0	110.0
Russia	1,235.0	1,235.0	1,110.0
Others	36.8	36.8	34.1
Total	1,454.3	1,454.3	1,316.1
World total	15,123.4	14,943.1	13,664.3

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Other Communist includes China and Yugoslavia as well as the Soviet satellite countries in Europe.

ever, with production from International Egyptian Oil Co., Inc.'s new Belayim and Feiran fields. Plans call for an output of 10,000 bbl. daily from these Sinai Peninsula fields by the end of the year.

Two of Europe's most oil-conscious nations, France and West Germany, each had a slight rise in production. West Germany's oil flow of 57,800 bbl. daily was up 600 bbl. from the previous month for another new record. Output in France was up 200 bbl. daily to 12,300 bbl. daily.

Total production in the Western Hemisphere outside the U.S. was off slightly from the February level. Venezuelan output was 2,144,800 bbl. daily, or 5,000 bbl. daily less than the all-time record production of the previous month. Canadian production in March was 312,000 bbl. daily, off 7,000 bbl. daily, or 2.2 per cent from the previous month.

Soviets Adjust Oil Goal

Greater stress on development of oil and natural gas accompanies new Russian policy to build heavy industry

AN even stronger emphasis on the development of oil and natural gas is apparent from recent developments in Soviet Russia.

Most important indication of this trend was the recent appointment of Nikolai K. Baibakov, former minister of the oil industry, as head of the State Commission for Prospective Planning. This group develops the long-range goals for the Soviet industrial economy.

Baibakov is a top Russian oil expert. His appointment has been interpreted as another clue to Soviet plans for stepped-up petroleum development.

The Russian Communist newspaper Pravda commented recently that increased petroleum production would permit the country "to introduce highly profitable changes in the fuel-power production balance of the country and switch a number of fuel-consuming sectors of the national economy over from solid fuel to the more economical and efficient liquid and gaseous fuel."

Baibakov's successor as minister of the oil industry is Mikhail Andrianovich Evseyenko, former minister of construction of oil-industry enterprises. The post Evseyenko vacated was filled by Alexei Kirillovich Kortunov.

New policy . . . Added stress on oil and gas operations is in line with the current Russian program of pushing heavy industry at the expense of consumer goods. The Soviets returned to this policy following the resignation of Premier Malenkov, who had given primary attention to raising Russian living standards.

The top Russian leader, Nikita S. Khrushchev, first secretary of the Communist Party, gave indications of Russia's concern with expanding energy sources, including coal, water, and atomic power, as well as oil and natural gas. He said that such activities require long-term planning for periods of 10 to 15 years.

Though the Russian petroleum industry is still beset by many difficulties, total production has surged ahead since the end of World War II. In 1945, output from the country's fields, many of which were devastated during the war, fell to a low of about 21,000,000 metric tons, or approximately 420,000 bbl. daily.

Production up . . . Last year Russian oil production reached 58,000,000 tons, or about 1,160,000 bbl. daily. This reflects an average annual increase of about 12 per cent during 1949-1954. Russian production figures are based on the Soviet's own occasional statements, but they are in general confirmed by the analyses of Western experts.

The revised 5-year plan called for a total output of 70,000,000 tons, or some 1,400,000 bbl. daily, for the current year. It now seems that the country will fall somewhat short of this goal since it would mean doubling the increase of recent years. However, another sharp gain in output is anticipated during 1955.

Russia also has been making strong efforts to increase production and distribution of natural gas. The 5-year plan called for an output this year of 6,300,000,000 cu. m. of this fuel—equivalent to about 610,000,000 cu. ft. daily—but it is also unlikely that this goal will be reached. Moscow and Kiev receive natural gas, and Leningrad is provided with gas from the large Estonian shale industry. In some cases, however, the Russians have built gas pipelines without providing sufficient consumer gas-burning equipment to operate the system at anything like capacity.

Oil prospects . . . There are extensive sedimentary areas in the Soviet Union, and there is little doubt the country's undiscovered oil resources are large.

Turkey Grants Oil Exploration Permit

Gilliland Oil Corp., Los Angeles, has been granted an exploration permit by the Turkish Government and expects to start its first test in southeast Turkey in about 6 months. The company is the first independent to be granted an exploration permit. It allows geological activities to be carried on throughout Turkey except for the defense areas. President of the Turkish Petroleum Administration, Emin Iplikci, is shown above giving the permit to Celalettin D. Bukey, general agent for Gilliland in Turkey. Others shown are, left to right, Erol Bukey, assistant general agent; E. N. Egeron, first assistant to Iplikci; and C. E. Tasman, chief of the geological department of the Turkish Petroleum Administration. The new firm is a joint undertaking of J. H. Gilliland, owner of the Gilliland Oil Co., and Howard F. Ahmanson, also of Los Angeles. Ted L. Bear, formerly with Humble Oil & Refining Co., is carrying out the preliminary geological work in Turkey. Earl Gard is advising the company in construction matters.

Last year, Baibakov criticized his own industry, in the characteristic Communist fashion, for an "overlarge, bureaucratic apparatus." He said local managers often depend too heavily on new, flush production without properly using secondary recovery and other modern methods of oil recovery.

Russian disregard of some standard Western practices, such as safety, is fairly well known. Baibakov himself indicated the results of this and other Russian operating methods when he said that the drilling goal for the last 2 years had not been fulfilled because of time lost through shutdowns and accidents.

Another instance of Russian self-criticism regarding its oil industry came recently from Pravda. It asserted oil and natural gas were being underrated in the Russian economy and declared the deficiencies in development were due not only to objective difficulties but also to "ignoring economic factors in planning the development of the over-all fuel industry."

Australia Hits Oil

New producer only 30 ft. from 1953 discovery well

A SHALLOW well in Western Australia has confirmed the 1953 oil discovery made by West Australian Petroleum Pty., Ltd., at Rough Range.

The new producer is only 30 ft. west of the discovery. It flowed at a rate of 60 bbl. an hour on a 4-hour test with clean oil reaching the surface 12 minutes after tool was opened. Production was from a zone at about 3,603 ft.

The discovery well found oil at 3,605-20 ft. and was drilled later to slightly below 14,000 ft. in the hope of finding deeper production. Some inconclusive shows were found below 9,000 ft. Mechanical difficulties prevented completing the well in the originally productive zone.

Rough Range 1 flowed oil at a rate of 23 bbl. an hour. The crude was highly paraffinic and tested about 40° gravity.

After making the discovery, the company, known as WAPET, drilled seven dry holes at varying distances from the first well before drilling the second producer. These failures indicated a very small oil deposit.

John W. Thomas, WAPET manager, pointed out that the new well merely affirmed the discovery made in November 1953. He warned that the initial flush production rate could not be expected to be maintained on a longer test.

All units in operation at . . .

New Australian Refinery

WITH the commissioning of a 5,600-bbl. daily Hydrofiner, all units are now in operation at British Petroleum Co., Ltd.'s new 60,000-bbl. refinery in Kwinana, Western Australia.

The Hydrofiner removes sulfur from gas oil in a process which permits recovery of more than 90 per cent of the feed. Similar plants are being built at B.P. group refineries in Kent, England, and Hamburg, Germany.

The process is comparatively simple. A feed stock comprising a mixture of kerosine and light and heavy straight-run gas oils is passed with hydrogen over a catalyst. The temperature is 780° F. Pressure is 1,000 psi. The sulfur in the feed is removed as H_2S.

Other units . . . Hydrogen for the plant in Kwinana is supplied by the refinery's 5,700-bbl. Platformer, which also was recently placed in service. The first distillation unit was placed on stream in February, 3 months ahead of schedule. Since then, other facilities put into operation include a second distillation unit, a vacuum distillation unit, and an Orthoflow catalytic cracker.

The refinery is operated by Australasian Petroleum Refinery, Ltd., for B.P. It was designed by M. W. Kellogg Co., and construction was supervised by Kellogg International Corp. Cost of the refinery and its auxiliary facilities was about $150,000,000. The project was built on a once-isolated stretch of beach on Cockburn Sound, south of Fremantle.

Crude oil is being brought to Kwinana from Kuwait and Iran. About one tanker a day is arriving at the refinery jetty, which can accommodate three super tankers at one time. Three 16-in. lines carry the crude to the tank farm, which has more than 80 storage tanks.

Growth of industry . . . Seven weeks after the commissioning of the first unit, the first gasoline was pumped through a 17-mile, 6-in. pipeline connecting the refinery with storage facilities at the Port of Fremantle. Fuel oil is being pumped through a 15-mile, 12-in. pipeline from the refinery to ships' bunkering installations at the port. Cargoes of black oil products are being shipped regularly to Australia's East Coast ports.

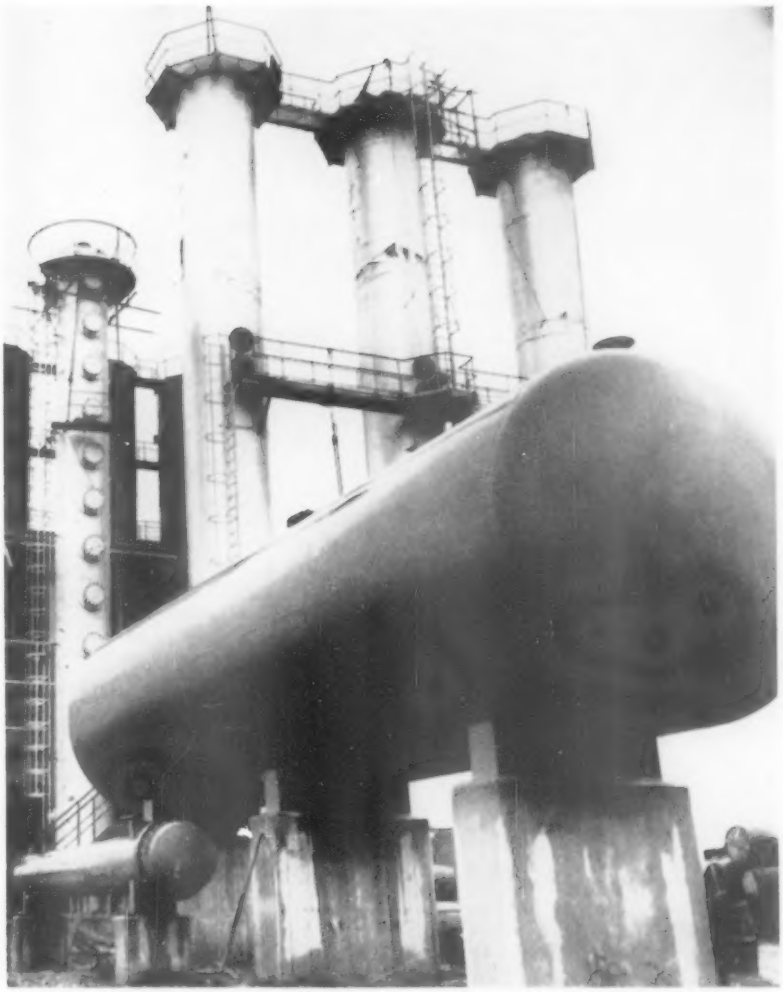
The Kwinana refinery is one of four such projects undertaken in Australia in recent years. A 25,000-bbl. daily refinery at Geelong, near Melbourne, was placed in operation by Shell last year. In April, Standard-Vacuum Oil Co.'s subsidiary, Standard-Vacuum Refining Co., Ltd., placed a 25,000-bbl. plant on stream at Altona, near Melbourne. Caltex is building a 22,000-bbl. refinery near Sydney, New South Wales. It is due to be completed this year.

When all four units are placed in service, they will bring the total refining capacity in Australia to 149,000 bbl. daily.

Petrochem Plant Proposed

An $8,000,000 petrochemical plant will be built near Antwerp, Belgium, by Ste. Chimique des Derives du Petrole (Petrochim).

The plant will manufacture a variety of compounds, utilizing gases from refineries in the Antwerp region. Included in the facilities will be ethylene-oxide and ethylene-glycol production units, designed by Scientific Design Co., Inc. The plant is scheduled for completion in 1956.



PURIFICATION AND BENZOL stripping units recently were erected.

Aussies Turn to Coal Gas

New installation at Morwell in Victoria also being designed to make synthetic liquid fuel in slack gas-demand season

AN interesting future is being mapped for an Australian plant now being designed primarily to concentrate on production of town gas from brown coal.

Its refining processes will be tied into production of synthetic liquid fuel —probably the world's first large-scale development of this combination.

Gas & Fuel Corp. of Victoria, Melbourne, has begun the plant at Morwell and hopes to manufacture its first gas in 1956.

Long-range plans, however, visualize continuous expansion of the plant to include Fischer-Tropsch equipment to synthesize oil and gasoline from brown-coal gas.

Refinery program . . . The company hopes to have the first synthesis unit operating in 1960 and then gradually to expand production until 1976 when an annual output rate is visioned of 60 million gallons of liquid fuel products, 27 million gallons of which will be gasoline.

Gas & Fuel Corp. officials, in planning the Morwell project, took account of Australia's privately financed refinery construction program and the present cheap world price of crude and low tanker rates. The nation is expected to be self-sufficient from foreign imports of petroleum products when the four refineries now building or planned are completed.

But they are banking on several other favorable economic factors:

. . . The gas plant would be partly idle during the non-winter months and its facilities then could be economically converted to production of synthetic oil and gasoline.

. . . World consumption of petroleum and its products is increasing with 42 per cent of the world's known reserves centered in one area around the Persian Gulf.

. . . Thus greater demand and dwindling supplies could move more synthetic oil and gasoline into a prime competitive position.

Linked with these factors is an almost unlimited cheap supply of brown coal as the primary raw material.

Once regarded as almost worthless, the brown coal deposits extending along the Latrobe River Valley in Gippsland, eastern Victoria, are now recognized as a most valuable asset. The rich coal belt, practically continuous for 40 miles, is between 5 and 10 miles wide and is 757 ft. thick at a depth of only 89 ft. below the surface. It is the richest known coal seam in the world, containing 20,000 million tons of proven coal suitable for open-cut working.

A second important coal deposit lies at the new plant's backdoor in the Morwell field where 10,000 million tons are available in a 380-ft. seam 54 ft. below the surface.

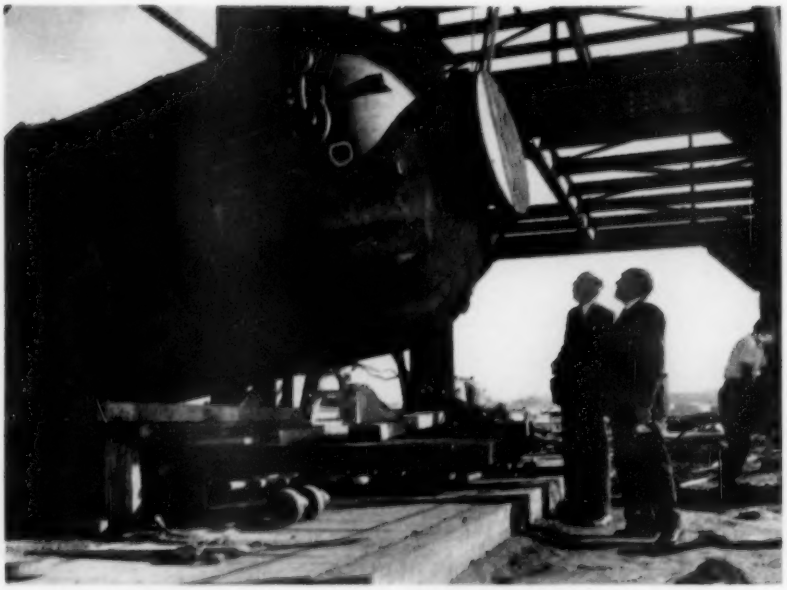
Brown coal briquettes for the Morwell plant first will be delivered from Yallourn in the Latrobe Valley until a briquette plant can be completed at Morwell.

Use German process . . . The Lurgi process, developed in Germany, will be employed at the Morwell plant in manufacturing town gas. Under this method, oxygen and steam under 300 psi. pressure are applied to the incandescent bed of brown coal. The gas obtained is 20 per cent rich methane. The brown coal briquttes also are completely gasified, the gas being produced in a generator under a 450-psi. pressure and thereafter purified while still under pressure.

Sensible heat in the crude gas converts water to low-pressure steam in waste heat boilers and a thick primary tar, none of whose constituents boils under 200° C., is deposited.

In secondary coolers a light tar containing 50 per cent light oil boiling at under 200° C. is deposited. Carbon dioxide and hydrogen sulfide content are removed from the gas in water wash towers while benzole is removed by oil washing.

The initial plant at Morwell will consist of six Lurgi generators with auxiliary plant and two oxygen pro-



FI25T GAS GENERATOR is placed into position at Morwell

ducing units. Initial output will be 15 million cubic feet of gas daily, with 300,000 gal. of high octane gasoline and one million gallons of brown coal tar annually.

Production should be doubled by 1959 and by 1960 the Fischer-Tropsch equipment should be ready to synthesize oil and gasoline from the carbon monoxide and hydrogen content of the brown coal gas.

Gas & Fuel Corp. planners point out that costs should be reduced by having two distinct outlets for different parts of the rich gas produced. The town gas production for domestic and industrial consumption will represent 70 per cent of the cost of liquid fuel products. This will place them in a good competitive position marketwise in Australia.

New African Terminals Built

Distribution of petroleum products in Africa is being improved with the addition of new terminal facilities in two widely separated locations.

Lubricating oil blending facilities are being added to Caltex (Africa) Ltd.'s Island View terminal in Durban, Union of South Africa. Construction on the $600,000 installation is under way and is scheduled for completion during the first half of next year.

In northern Africa, a modern petroleum terminal costing $450,000 will be built near Tripoli, Libya, by Esso Standard (Near East) Inc. It will supply Wheelus Field, a U. S. Air Force base. Esso also plans to build a terminal in the Libyan province of Cyrenaica.

France Enticing

Socony Mobil seeks big acreage in Paris basin

THE exploratory play in France has attracted another major oil company.

Socony Mobil Oil Co., Inc., through an affiliate, is seeking a concession over about 1,230,000 acres in the northeastern part of the country.

The request for exclusive exploration rights over the area was made by Socony-Vacuum Francaise, S.A. Activities of the company previously have been in the refining and marketing field.

The acreage sought by the company is in the departments of Aisne, Ardennes Marne, Oise, and Seine-et-Marne. The Paris basin, in which the area is located, has been attracting increasing attention. Esso Standard, S.A.F., and Royal Dutch-Shell also recently filed for concessions in the region.

New producer . . . In southwestern France, the Esso company has started production at its discovery well at Mothes *(The Oil and Gas Journal, May 9, page 100)*. The well, about 7½ miles east and slightly north of Parentis field, is producing 55 tons daily of 22.3°-gravity crude. The output is equivalent to about 380 bbl. daily.

The crude was described as having a very low sulfur content. It yields less gasoline and more heavy ends and asphalt than the Parentis oil. Esso announced in Paris that a second well will be drilled about 1.8 miles north of the 1 Mothes.

Law changed . . . The French Government has made several changes in its old mining law. The modifications were among several economic reforms in various fields introduced by government decree.

Mining permits, previously limited to 3 years with the possibility of extension, will now be for 5 years with two possible extensions of 5 years each.

Use of Products Up

United Kingdom gains in everything but kerosine

CONSUMPTION of petroleum products in the United Kingdom during 1954 averaged about 420,000 bbl. daily.

Figures compiled by Petroleum Information Bureau in London indicated that consumption during the year totaled 21,038,511 tons, an increase of more than 2,000,000 tons over 1953. It was the first time that consumption passed the 20,000,000-ton mark. The total excludes bunkers for ships engaged in foreign trade.

Gas, diesel, and fuel-oil consumption averaged about 130,000 bbl. daily. Much of this, about 51,000 bbl. daily, was used in the manufacture of steel and for steam generation.

Premium gasoline became more popular during 1954. It accounted for nearly 64 per cent of gasoline sales last year against 58 per cent in 1953. Total consumption of premium and regular grades was about 138,000 bbl. daily, up 3 per cent over the previous year.

Kerosine, used at a rate of about 28,000 bbl. daily, was the only major product to show a decline during the year. The falling-off was attributed to a preference for diesel-engined tractors.

International Briefs

The Egyptian Government has sent six engineers to England for 6 months intensive training in refinery practices. The party is headed by captain engineer Abu Bakr, who will study refinery administration.

Creole Petroleum Corp. has posted prices for the first time for products refined at its Amuay and Caripito refineries in Venezuela. Prices are listed for 12 products not heretofore publicly quoted. The prices are similar to those of Esso Export at Aruba and compare with posted prices on the U. S. Gulf Coast.

SPECIAL SECTION

Report on Fourth World Petroleum Congress

plus

"ITALY'S OIL AND GAS"

. . . a four-part discussion of the present status of the industry in the nation that is acting as host to visiting oil men

Reception hall of the Congress Building, left, and one of the "International" Buildings Group (E.U.R.) at Rome, where the Fourth World Petroleum Congress is convening this week.

4,000 Oil Men Gathered in Rome

Ten-day congress attracts technologists and economists from 35 nations

by Kenneth B. Barnes, editor, and Wilbur L. Nelson, technical editor

ROME.—Report to The Oil and Gas Journal from its editors attending the Fourth World Petroleum Congress is that total attendance will approximate 4,000 for the 10 days of technical sessions stretching from June 6 through June 15. Delegates from all the leading oil countries in the Western and Eastern Hemispheres are in attendance. A total of 35 countries are represented.

The World Petroleum Congresses have as their aim the intensification of international exchanges in new technical and economic matters for the oil and gas industries. The congresses are held as quadrennial meetings. The first was held in London in 1933, the second in Paris in 1937, and the third in The Hague, 1951. Publisher of the complete proceedings for the Fourth World Petroleum Congress is Carlo Colombo, Via Camp Marzio 74, Rome.

News reports of some of the leading papers under discussion at this Fourth World Petroleum Congress, Rome, are as follows:

Section 1—Geology and Geophysics

New developments, advanced techniques, and unusual aspects of oil finding featured the exploration papers presented before the Fourth World Petroleum Congress:

M. King Hubbert and David G. Willis stressed that fractured reservoirs are an important source of oil. This type of reservoir has already produced about 0.7 billion barrels of oil in the United States. Hubbert forecast that the ultimate production from fractured reservoirs in the United States may exceed 2.5 billion barrels. The Ellenburger formation of West Texas is

the most prolific fractured reservoir, but many other formations produce from this type of reservoir. California has several important fractured reservoirs in the upper Miocene, and Upper Cretaceous shales, and in metamorphic rocks of Jurassic age. Production from fractured reservoirs can be very erratic; 500,000-bbl. wells (ultimate) may offset wells that will produce less than 10,000 bbl.

More oil by facies studies . . . Geologists in the past have considered that only structural analysis can be treated precisely. The other factors controlling oil accumulation, source beds and reservoir strata, are very complex, but it is up to the geologist to sort out and map these complex patterns. Dr. L. L. Sloss, of Northwestern University, outlined various methods of mapping facies changes or variations in the characteristics of sediments in a paper entitled "Location of Petroleum Accumulation by Facies Studies." Dr. Sloss breaks facies studies in oil exploration into four levels, with each level taking into consideration greater detail and a smaller area. These levels are:

1. Regional studies that cover an entire depositional province.

2. "Semiregional," or basin studies aimed at extending productive trends within a single sedimentary basin.

3. District studies, designed for the development of new pools or exploiting untapped zones within oil-producing areas.

4. Pool studies, which attempt to expand known fields, particularly where nonstructural traps were involved.

With the decline in geophysical activity and the increase in emphasis on strat traps, facies studies will play a key role in guiding future exploration.

Origin of oil . . . Present data indicate that oil begins to form soon after the deposition of the sediments, although it was previously thought that liquid hydrocarbons did not exist in the Recent sediments. P. V. Smith, Jr., Esso Development & Engineering Co., reviewed the "Status of Our Present Information on the Origin and Accumulation of Oil." Delegates were astonished to learn that Recent sediments off the Louisiana coast contained over 10 million barrels of crude oil per cubic mile of sediments. These sediments are characterized by relatively low organic carbon contents, oddly enough.

Even the first foot of sea-floor sediments contains hydrocarbons; and the hydrocarbon content increases very rapidly with depth.

Royal Dutch-Shell Group scientists, T. T. Grimsdale and F. P. C. M. van Morkhoven, discussed the relationship between various forms of animal life and the depth of the sea water in which sediments were deposited. There appears to be a valid correlation, but additional data are needed to support their conclusions, the authors said.

Salt-dome studies find more oil . . . New thinking in subsurface geological studies of Gulf Coast salt domes has resulted in the discovery of many millions of barrels of oil and trillions of cubic feet of gas. Authors Michel T. Halbouty, Houston oil geologist, and George C. Hardin, Jr., outline how salt-dome studies could be approached and showed some of the results. According to Halbouty and Hardin, the new traps can be grouped in seven categories:

1. Traps caused by peripheral and tangential faults.

2. Traps caused by sand pinchouts against the salt plug.

3. Traps caused by sand pinchouts, several hundred to several thousand feet from the salt plugs.

4. Traps in radial fault segments.

5. New reservoirs located by deeper drilling.

6. Traps occurring beneath salt-dome overhang.

7. Redrilling of old productive areas with the use of modern logging techniques.

Geophysical Studies

Geophysical crews have been exploring the offshore possibilities of the United States for the past several years. New and different equipment was a necessity and the geophysical industry has successfully met the challenge, according to Henry Cortes and Ronald N. Gsell, Magnolia Petroleum Co., Dallas. During the past few years offshore-exploration costs have been reduced so that it can be done as cheaply as seismic work on land.

Careful coordination between geological and geophysical data is essential to a successful exploration program, D. C. Skeels, Imperial Oil, Ltd., affirmed; he used several interesting examples, showing how better coordination gives a more reliable picture.

New developments . . . Henry Salvatore, president, Western Geophysical Co. of America, told the congress that geophysical methods and devices have been steadily improved, although no fundamental changes have taken place. "Today's research is necessarily the forerunner of tomorrow's technology," Salvatore said in emphasizing the importance of geophysical research.

Improved gravity and magnetic interpretation . . . Dr. Sigmund Hammer, Gulf Research & Development Co., Pittsburgh, recognizes a definite trend in exploration work toward the quantitative use of magnetic and gravity data. He said that in the past these methods were used only casually, but now the trend is reversed. Improved handling of these data is increasing the value of gravity and magnetic work.

Reef exploration . . . Both gravity and seismic methods can delineate reefs, but seismic work is the more effective way of locating these prolific oil traps, F. J. Agnich, executive vice president, Geophysical Service, Inc., Dallas, said. Reflection seismic surveys have been highly successful in mapping reef trends. Refraction and gravity surveys in reef exploration are limited to those areas where the reefs occur at the shallow depths. Agnich listed four important criteria for reef identification in seismic work:

1. Folding of beds above reef due to differential compaction.

2. Appearance of a velocity high on reflections from beds beneath the reef.

3. Abnormal divergence between beds immediately above the reef and beds below the reef.

4. Absence of or poor quality of reflections coming from within the reef.

Section 2—Drilling and Production

"The industry can expect further progress in well-completion technology as the benefits of those techniques now in use are better appreciated," A. L. Solliday, executive vice president of Stanolind Oil & Gas Co., told the congress.

"The high costs of discovery and drilling oil wells, coupled with an increase in the demand for oil, has emphasized the need for better well productivity and higher ultimate recovery," Solliday emphasized in his paper entitled "Modern Well-Completion Methods in U.S.A."

Well completion has become a refined technique; and Solliday outlined criteria to aid in selecting the best methods for various reservoir conditions encountered.

Latest developments in well completions are:

- Refinements and new applications of hydraulic fracturing.
- Special drilling fluids that prevent contamination of the producing zone.
- New methods and tools that eliminate the need for a drilling rig during completion operations; this reduces the cost of the well.
- Acidizing and chemical treating techniques that have been improved by the use of surfactants and additives.

New drilling developments . . . Conventional drilling methods are rapidly approaching their practical and economic limits, W. B. Brooks, L. W. Randerson, and F. W. Schall, Magnolia Petroleum Co., Dallas, reported. Several new drilling techniques are worthy of consideration by the petroleum industry as a possible answer to cheaper and more efficient drilling. Some of these are already in use, but others require improved technology and metallurgy before they can be considered of economic importance. The authors reviewed the more important techniques:

1. Shaped charges—high costs and present results indicate this method of drilling is not feasible now or in the future.

2. Thermal jet-piercing—this method develops temperatures up to 4,300° F. and has been used successfully in the mining industry. But there are many hurdles to overcome before it can be converted to oil-well drilling.

3. Electric-arc drill—has not yet been used commercially, but might be applicable to shot-hole or shallow drilling.

4. Sonic drill—laboratory tests are encouraging, but the system is very susceptible to mechanical breakdown. If the drill is durable enough, it may prove commercially successful.

5. Electric vibratory drill—still in the development stage, but results are encouraging.

6. Electrically driven motors at the bottom of the drill string—restricted at the moment to relatively shallow holes, but the method has many advantages over conventional methods.

7. Fluid-driven motors at the bottom of the drill string—these turbine motors may be powered by air, gas, or drilling mud. Size and power limitations have retarded the use of air or gas-turbine drilling devices. But those used with drilling mud hold out promise since trial runs have indicated fast penetration rates, long bit life, straight and true gage holes and improved hole conditions when compared with conventional drilling.

8. Rotary percussion drilling—still in the experimental stage.

9. Diamond drilling and coring—field proven and may result in substantial savings in well costs.

10. Jet-nozzle rock bits—give improved drilling performance when properly operated.

11. Hard formation rock bit—field results show this type of bit gives four to eight times the footage of conventional bits when drilling extremely hard and brittle formations.

12. Air drilling—has proved desirable in many areas of the country and its use is becoming more widespread.

J. E. Walstrom, Standard Oil Co. of California, as editor, presented a comprehensive "Symposium on Well Bore Surveys" in discussing the various types of surveys and logs. It is an up-to-date and comprehensive review and the major logging companies contributed many of the articles included in the symposium. The articles, written primarily for the oil man, discuss:

1. What information or data the method provides.

2. How and for what purpose this information is used.

3. The extent of application of the method in drilling and production operations.

5. The advantages, disadvantages, and limitations of the method.

6. How the information provided by the method is coordinated with information provided by other methods.

Thermal drive recoveries . . . Ivan Heininger and N. Schwarz, Koninklijke/Shell-Laboratorium, Amsterdam, presented results that showed hot-water flooding of an oil reservoir may economically increase the recovery by 50-70 per cent or more, if a cheap source of energy is available.

The authors said that solution-gas-drive fields offer no prospects for heating methods. Water-drive fields, however, offer good prospects and the higher the oil-water viscosity ratio, the better the recovery.

Fissured reservoirs . . . The remarkably high rates of production obtained from fissured reservoirs do not require either a large fissure or a great frequency of fissuring, W. J. Baker, Anglo-Iranian Oil Co., Ltd., said. He emphasized that it was important for the fissuring to be widespread so that it covers a large area if not the entire producing formation. Baker cited the Asmari limestone where high rates of production are obtained from a rock of very low permeability. These facts help explain the good results obtained in formation fracturing. Baker concluded that an important increase in world production would result if artificial fracturing could approximate good natural fracturing.

J. Birks, Anglo-Iranian Oil Co., presented the results of "A Theoretical Investigation into the Recovery of Oil from Fissured Limestone Formations by Water Drive and Gas-Cap Drive." He defined a fissured-limestone formation as a reservoir that consists of blocks of oil-bearing limestone of low permeability separated from each other by fissures that offer a negligible resistance to fluid flow. The choice of water or gas as the repressuring agents in this type of reservoir can be made by calculating their relative efficiencies by methods that Birks outlined.

New sampling technique . . . J. Delacour, Societe de Prospection Electrique, Procides Schlumberger, Paris, described a new method of taking fluid samples from formations cut by the drill. The equipment consists of a series of suction core barrels operated by means of a lateral core of the conventional type. Each core barrel adheres to the boring wall at the level of the formation studied. The fluid from the interstress is then sucked inside the core barrel chamber where it remains until recovered aboveground. Field experiments have shown that gas and oil samples can be taken in the immediate vicinity of the well bore.

Directional wells . . . Eighty-seven wells with drift angles greater than 60° have been drilled and completed off the California coast, Daniil S. Johnston, Signal Oil & Gas Co., and James T. Carried, Southwest Exploration Co., reported. Leases lying 2 miles offshore have been developed using new tools and new drilling and completion techniques.

Oil-well gravel packing . . . Field data show that gravel packing is a successful completion method in the Miocene sands of Trinidad, B.W.I., according to A. S. Curlet and R. Pike, of Trinidad Leaseholds, Ltd. They consider that this technique can be a standard completion method for new wells exploiting thick low productivity sands in areas where troublesome formation movement is expected.

F. H. Lahee, Sun Oil Co., Dallas, recommended that a standardized terminology on oil and gas reserves be adopted. Dr. Lahee outlined a method for classifying reserves and suggested that authors and speakers on the subject of reserves always explain their figures to avoid confusion or misunderstanding.

Stuart E. Buckley presented a paper on "Correlation of Ultimate Oil Recovery with Reservoir Characteristics." The paper describes the manner in which a reservoir may be appraised and the proper recovery method selected.

Walter F. Rogers and J. A. Rowe, Jr., Gulf Oil Corp., Houston, discussed "The Corrosion Effects of Hydrogen Sulfide and Carbon Dioxide in Oil Production." The authors developed a theory covering the causes of high corrosion rates in sulfide environments.

Today's drilling machinery is a great improvement over that of a decade ago, but there will be additional improvements in the future, Georg Bieret and Erich Bahke, Salzgitter Machinen, Salzgitter-Bad, West Germany, said. Manufacturers are finding ways to reduce the size and weight of components. The modern thinking man will have to get acquainted with lightweight construction ideas to cut down dead weight in machines and equipment, the authors concluded.

Section 3—Oil Processing

The big news in oil processing is that the established processes are being improved and new ones, designed to alleviate current refining problems, are being announced frequently.

Vladimir Haensel and J. F. Walter, Universal Oil Products Co., Des Plaines, Ill., presented the latest developments in Platforming. High paraffinic stocks are upgraded through dehydrocyclization and selective hydrocracking. Highly naphthenic stocks are improved by conversion of naphthenes to aromatics. The combined Unifining-Platforming operation is used for upgrading cracked and coker gasoline and high-sulfur sraightrun stocks.

J. K. Roberts, E. W. Thiele, and R. V. Shankland, Standard Oil Co. (Ind.), Whiting, outlined the Ultraforming regenerative platinum-catalyst reforming process for naphthas. The process uses low operating pressure to give better yield of gasoline and more selective processing. The catalyst may be regenerated many times satisfactorily.

M. J. Fowle, R. D. Bent, and B. E. Milner, Atlantic Refining Co., Philadelphia, outlined the use of the Catforming process to improve naphthas by isomerization and dehydrogenation. The process can be used to emphasize the most desirable reactions.

J. W. Hyde and F. W. D. Porter, British Petroleum Co., Ltd., Sunbury-on-Thames, England, described improvements made in the Autofining process by development of an improved catalyst and changes in operating techniques in the production of diesel fuels.

Recent Houdriflow Improvements

H. D. Noll, J. G. Dart, and R. E. Bland, Houdry Process Corp., Philadelphia, reviewed the recent improvements made in the Houdriflow catalytic cracking process. The process is highly flexible in handling different charge stocks and in cracking at different percentage conversions.

E. J. Gohr, Esso Research & Engineering Co., New York, described the recent advances in fluid catalytic cracking. Fluid plant investment and operating costs have decreased substantially during the last few years. The new designs are simpler and more compact. Process can now be used to crack heavy fractions and operates well on recycle cracking.

E. V. Bergstrom, V. O. Bowles, L. P. Evans, and J. W. Payne, Socony-Vacuum Laboratories, New York, told of the improvements made in the Thermofor catalytic cracking process since 1951. A mixed-phase feed technique is currently being used in several units. Metals poisoning is being prevented by selective removal of metals from the system with the catalyst fines.

Ernst W. Nagelstein, Dr. Ing., Paris and Marxzell, Kreis Karlsruhe, explained how to improve activity and selectivity of solid catalyst. Homogeneity of solid catalysts depends on strict control of the contact times between the fresh precipitate and the precipitation solution. A correlation between contact times and activity and selectivity has been obtained.

M. J. H. Small, P. H. S. Kirkaldy, and A. Newton, Trinidad Leaseholds, Ltd., Point-a-Pierre, Trinidad, pointed out the effect of deactivating agents on the

performance of silica-alumina cracking catalyst. Sodium causes activity deterioration without affecting selectivity. Removal of carbon improves activity of equilibrium catalyst. High temperatures are mainly responsible for the final state of equilibrium catalyst.

J. A. Beukers and H. P. Kelder, Esso Standard Refinery, Antwerp, pointed out the advances of combination processing in petroleum refining. This technique results in considerable investment saving and greatly reduced operating cost. Proper design, including adequate instrumentation, will eliminate objections based on complexity of inspection and maintenance work, and reduce the possible effects of operational upsets in one section on the other processing steps of another section.

A. Voorhies, Jr., Esso Standard Oil Co., Baton Rouge, described the new process for fluid coking of residua. This process can successfully handle the lowest quality and the shortest residua produced by vacuum distillation and also the very poorest grade of residua, including asphalts and thermal cracking coal tars. Excellent liquid yields of good quality are obtained.

A. O. Pukkila, H. W. Shea, J. W. Batholomew, and R. B. Killingsworth, Socony Mobil Oil Co., Inc., and affiliates, described the first commercial unit for percolation of lubricating oils by the Thermofor continuous-percolation process. The process is quite flexible and can produce high-quality lubricants from widely varying charge stocks.

H. Krekeler, Farbwerke Hoechst A. G. Frankfurt a. Main-Hoechst, described the Hoechst continuous coking process. This process is very versatile in that it can use crude oil, brown coal-tar oil, cracked oils, and residues as feed stock.

Atmospheric Pollution

A. W. W. Kirby, Shell Refining & Marketing Co., Ltd., London, outlined the atmospheric pollution problems associated with the refining of Middle East crudes. Major problem: the handling of the large amounts of hydrogen sulfide associated with the crude.

I. McCallum, P. G. Layzell, and R. A. Vere, Esso Petroleum Co., Ltd., Fawley, England, outlined the methods for control of air-pollution problems at the Fawley refinery. Gas is preferentially used for furnaces, furnaces and stacks are designed to prevent smoke, and a deodorizer is used to treat spent caustic streams.

I. McCallum, J. A. Shaw, G. H. Gill, and D. A. H. Peters, Esso Petroleum Co., Ltd., Fawley, England, reported on the deodorization of refinery effluents. The system employed at Fawley uses a combined neutralization and stripping of the spent caustic and hydrogen-sulfide bearing streams. The operation is carried out using hot boiler flue gas and steam.

W. E. Bradley, G. W. Hendricks, and H. C. Huffman, Union Oil Co. of California, Brea, Calif., reviewed the possibilities of petroleum refining with hydrogen. Naphthas and solvents, kerosines, gas oils, and lube oils can now be economically desulfurized and upgraded with hydrogen. Hydrogen is generally available as a byproduct from catalytic reforming.

M. Pier, Ammonia Lab. Badische Anilin & Soda-Fabrik AG, Ludwigshafen a Rhein, discussed hydrogenation of crude oil in Germany. The four hydrogenation plants in West Germany have now combined hydrogenation with thermal and catalytic cracking. Cracked middle oils and residues can either by recracked or processed directly to high-grade fuels by hydrogenation.

A. Gislon and J. M. Quiquerez, Centre de Recherches de la Compagnie Francaise de Raffinage, described a new process for desulfurizing petroleum products. This consists in oxidizing mercaptans by air at room temperature in the presence of kelate compounds. The kelate is dissolved in cresol or methanol and the process carried out in a neutral medium.

A. Champagnat, J. Laugier, Y. Rollin and C. Vernet, Societe Francaise des Petroles BP, described the selective separation of normal paraffins from petroleum fractions. Addition of urea to normal paraffins gives rise to crystalline adducts. The nonadducted hydrocarbons are removed with a special solvent.

L. N. Goldsbrough, Shell Petroleum Co., Ltd., Chester, England, outlined a process for the purification of a straight-chain hydrocarbons by urea extraction. Filtration is avoided by use of surface-active agents and inorganic solvents in aqueous urea solution. Pilot-plant results are good.

K. V. Gopalan, Assam Oil Co., Ltd., Digboi, India, reported on the use of urea for dewaxing washed blue oil from Indian crude oil. This process is successful but it appears that conventional M.E.K. extraction is more satisfactory and economical.

Section 4—Chemicals from Petroleum

The petrochemical industry in the United States, Canada, and Italy, received much attention in its Section 4 meetings of the 1955 World Petroleum Congress on "Chemicals From Petroleum." Other excellent papers dealt with oxidation of hydrocarbons including: (1) acetylene and acrylonitrile, (2) direct oxidation, (3) chemicals from acrolein, and (4) recovery and oxidation of xylenes. Developments in tetramer, cumene, and motor polymer manufacture are covered. Also in the program were uses and properties of polyethylene and the use of crude and reduced crude to make ethylene.

Almost 4 billion dollars' worth of inorganic, aromatic, and aliphatic petrochemicals will be produced in the United States in 1955, estimated J. P. Cunningham, of Shell Chemical Corp. He divided the relative production of these three major petrochemical categories in this way:

	Billion pounds per year
Inorganic	8.0
Aromatic	4.0
Aliphatic	19.0
Total	31.0

This is a projection made from the 1952 figures of Bateman and Field. Assuming the same average price this 1955 production will be worth almost 4 billion dollars.

The sale of hydrocarbons for chemical manufacture in 1953 returned to the U. S. industry as a whole approximately $180,000,000. Total value of chemicals derived from oil and gas in 1953 was in the order of 3 billion dollars.

Ammonia is the giant petrochemical among inorganics. Here natural gas dominates the picture as a source of hydrogen. Shell Chemical Corp., Lion Oil

Co., Phillips Petroleum Co., Union Oil Co., and Atlantic Refining Co. are oil companies participating in ammonia synthesis. These five oil companies operate 27 per cent of the national plant capacity. Their combined production has a value of around $80,000,000 per year. Other oil companies are coming into the ammonia field. Sulfur and carbon black are also important products of natural gas.

Greatest growth and diversification is expected in synthetic organic chemicals. Oil companies mentioned in the organic field are Gulf Oil Corp. (as manufacturer of ethylene and of isooctyl alcohol), Standard Oil Co. (New Jersey), Shell Chemical Corp., The Texas Co. (50 per cent ownership in Jefferson Chemical Co.), Standard Oil Co. of California, and Standard Oil Co. of Indiana. Jersey, Shell, and California Standard had gross incomes from chemical operations in 1953 of roughly $100,000,000, $125,000,000 and $50,000,000, respectively—a total of $275,000,000.

Canadian Petrochemical Industry

Capital investment in petrochemicals reached $230,000,000 at the end of 1953, reported A. W. Hutchison and R. G. Stevens of Shell Oil Co. of Canada, Ltd. The industry is centered mainly at: (1) Edmonton and Calgary in Alberta, (2) Sarnia in Ontario, and (3) Montreal in Quebec province.

Among the products made by Canadian Industries, Ltd., in Alberta are ammonia and polyethylene. Canadian Chemical Co., Ltd., is engaged in oxidation of hydrocarbons at Edmonton. At Sarnia, Dow Chemical Co. makes polystyrene and other organics. Phenol from cumene is made by B. A. Shawinigan at Quebec. Other companies are engaged in making organics, ammonia, and recovering sulfur.

Italy's first outstanding achievement in petrochemical production, the Ferrara plants, were described by Giulio Ballabio of the Societa Montecatini, operating agency for the government-owned project. He told about the many units now in operation, as well as others under construction or planned as part of a long-range program. Plants in operation are: polyethylene; polystyrene; isopropyl, butyl and isobutyl alcohols; acetone, dichloroethane, dibromoethane and ethyl chloride; plasticizers (phthalates) for polyvinyl chloride and terylene.

Manufacturing acetylene by partial oxidation of natural gas was the subject of a paper by E. Bartholome of the Badische Anilin-and-Soda Fabrik A.G. This process is now in use at Monsanto Chemical Co.'s plant at Texas City, American Cyanamid Co.'s Fortier plant near New Orleans, the SISAS plant near Milan, Italy, and the ACSA Co. near Venice. The basic principle for this method was suggested by Sachsse. Acetylene is formed by incomplete combustion with oxygen. A part of the methane, chief component of natural gas, is turned into CO, CO_2, H_2, and H_2O. The heat developed raises the temperature of the mixture to some 1,400° C. (roughly 2,500° F.) and furnishes heat for conversion of remaining methane into acetylene and hydrogen.

Making acrylonitrile from natural gas was described by J. T. Thurston, E. L. Carpenter, and F. Derbenwick of American Cyanamid Co. The authors told how this manufacturing process is carried out at their company's new integrated plant on the Mississippi River near New Orleans. The plant uses natural gas to make acetylene and hydrocyanic acid. From these intermediates acrylonitrile is made. Acetylene (99.5 mole per cent) is obtained through partial oxidation of methane. It is recovered from the quenched burner gas by solvent extraction. HCN is produced by igniting a mixture of natural gas, air, and ammonia on a hot platinum alloy gauze. Acetylene and HCN form acrylonitrile in a liquid-phase reaction.

E. T. Powers, of Celanese Corp. of America, presented a review of petrochemical manufacture by oxidation of methane, ethane, propane, and butane. He explained why use of pure methane as an oxidation raw material is discouraged by low yield obtained and the difficulty of separating the unreacted methane from remaining CO, H_2 and N_2. Cities Service at one time operated a low-conversion, one-pass oxidation but later replaced this to employ a natural gas from which nearly all methane and ethane have been removed. Synthesis-gas reactions and modified Sachsse acetylene are the only processes in the United States for oxidation of relatively pure methane.

There is no commercial oxidation of pure ethane in the United States. Propane and butane (L.P.G.) is oxidized by Celanese Corp. to a variety of chemicals. A large portion of Celanese's research activities have been directed toward oxidation of butane.

Shell Development Co.'s new process for the catalytic oxidation of propylene was described in a paper written by S. A. Ballard, H. de V. Finch, B. P. Geyer, G. W. Hearne, C. W. Smith, and R. R. Whetstone—all of Shell Development. The authors told why, as a result of this process, acrolein is potentially available as a low-cost petrochemical. Acrolein possesses a versatility equaled by few commercial chemicals. The carbon-carbon double bond can be reacted in many ways. The carbonyl group is reacted preferentially with acid anhydride and HCN.

Acrolein participates in reactions of the Diels-Alder type. Many chemical intermediates thus become available with potential applications in such diverse fields as poultry-feed supplements, cloth-treating agents, and sulfadiazine synthesis. (Ed. note: Use of acrolein as intermediate in manufacture of synthetic glycerin was announced before the W.P.C. meeting.)

Catalytic polymerization with solid phosphoric acid catalyzed is used for production of high-octane motor-gasoline material. However, it is also rapidly expanding into the petrochemical field with products such as tetramer, cumene, butyl benzene, ethyl benzene, etc. How this process operates was outlined in a paper written by Universal Oil Products Co.'s E. K. Jones and the late Gustaf Egloff. The operation consists of charging fresh propane-propylene feed and recycle to the catalyst chamber and fractionating the effluent. Tetramer can be made into the alkyl aryl sulfonate type of detergent.

Processes for recovery of o-xylene by fractional distillation and of n-xylene by fractional crystallization were explained in detail by W. G. Toland and E. L. Nimer of California Research Corp. The processes are now being used for large-scale manufacture of these isomers. Methods for oxidation of xylene isomers, particularly to the aromatic, dibasic carboxylic acids and their derivatives, such as phthalic anhydride and dimethyl iso and terephthalates, are reviewed. These processes are also described in greater detail: (1) air oxidation of o-xylene to phthalic anhydride, (2) air oxidation of m-xylene and/or p-xylene to toluic acids and further steps to make dimethyl phthalates, and (3) nitric acid oxidation of p-xylene to terephthalic acid.

Section 5—Composition of Petroleum

Newer and better methods for analyzing and testing petroleum are becoming available every day. This was the theme of the papers on Composition of Petroleum.

B. A. Fries, D. E. Hull, and S. B. Jones, of California Research Corp., La Habra, Calif., outlined the various uses and applications of radioactivity in the field of petroleum technology. In exploration for new oil fields, radioactivity surveys are now correlated with geological surveys. After a hole is drilled, the rock strata are identified with a radioactivity log. In pipeline transportation, radioactive tracers are used to locate lost scrapers and to find interfaces between consecutive stocks. In refining, radioactive tracers are used to measure levels, volumes, and flow rates. In the laboratory, radioactive materials are used to investigate such widely different things as oil recovery from porous rocks, mechanisms of chemical reactions, and the lubricating quality of marketed products. Chemical analysis of process streams with radiation sources has become routine. Continuous monitoring of plant streams and processes for automatic control now looms as a major develpment of the near future.

A. I. M. Keulemans and A. Kwantes, Koninklijke/Shell-Laboratorium, Amsterdam, outlined the use of vapor-phase chromatography in a petroleum laboratory for separating and identifying components of mixtures. It can be adapted to the analytical separation of almost all types of volatile compounds. It is characterized by speed and accuracy and does not require highly skilled personnel. Principle of the method is selective adsorption in a column packed with solid adsorbent.

M. J. O'Neal, A. Hood, B. J. Clerc, M. L. Andre, and C. K. Hines, Shell Oil Co., Houston, outlined the procedure for determining heavy-oil composition by mass spectrometry in combination with physical separation techniques. Mass spectrometry has wide applicability in the field of heavy-hydrocarbon analysis. A great deal of structural information can be obtained through present mass-spectrometric techniques.

H. Hyams, Shell Petroleum Co., Ltd., London, outlined the petroleum-testing methods and oil-measurement procedures recognized and used in about 70 countries. He also gave information about National Standards bodies and the extent of their work on oil and oil products. He stressed the need for international methods and procedures.

E. L. Baldeschwieler, Esso Laboratories, Esso Research & Engineering Co., Linden, N. J., outlined some new developments in analytical chemistry. These consist of techniques and procedures for more rapid analyses, improved accuracy, and the evaluation constituents which could not be heretofore determined.

A. Bestougeff and D. Bargman, Compagnie Francaise de Raffinag, outlined a new scheme for the complete chemical analysis of heavy petroleum residues and bitumens. By employing this method and new fractionating techniques, several distinct classes of components of these products can be separated and identified. Crystalline sulfur compounds have been discovered and separated from solid hydrocarbon mixtures found in Middle East petroleum residues.

W. L. Nelson, technical editor of The Oil and Gas Journal and head of the petroleum refinery department of University of Tulsa, Tulsa, with G. Thery Fombona and L. J. Cordero of the Ministry of Mines and Hydrocarbons, Caracas, Venezuela, outlined the relationship between sulfur content of crude oils and the sulfur content of conventional refinery products. Charts were used to estimate the sulfur content of straightrun and cracked products derived from representative crude oils, if only the sulfur content of the crude oil is known.

Section 6—Utilization of Products

Papers from this section covered motor fuels, developments in automotive engines, use of residual fuels in gas turbines, diesel fuels, and trends in lubricating-oil research.

The effect of fuels and lubricants on engine performance was brought out in a description of Esso Laboratories' studies of proper selection of fuels and lubricants. These studies—reported by Standard Oil Development Co.'s W. J. Sweeney, C. L. Fleming, Jr., and L. E. Moody—showed that such proper selection could save an average 5 to 10 per cent of the gasoline used in existing cars. These savings are achieved by using a high-octane-number fuel of balanced volatility with a multiviscosity-grade lubricant. The lubricant is made from selected stocks and additives to reduce engine friction and combustion-chamber deposits. Availability of such high-quality fuels and multivis lubricants should enable the automotive industry to produce the more efficient high-compression-ratio engines they are developing sooner than would be possible otherwise.

What's happening to automotive engines was outlined by D. F. Caris, A. D. McDuffie, B. J. Mitchell, and F. A. Wyczalek—all of General Motors Corp. They reaffirmed that improving the efficiency of automobile engines is one of the most important objectives of automotive engineers. Higher compression ratio, the key to efficiency, can be achieved by the use of higher-octane fuel and from development of mechanical octane numbers. Such factors as ignition control, valve timing, carburetion, engine-transmission relationship, and combustion-chamber design contribute to development of mechanical octane numbers.

New light on the chemistry of combustion-chamber deposits was offered by J. J. Mikita and B. M. Sturgis, of E. I. du Pont de Nemours & Co., Inc. Their report traced how unburned portions of fuels and oils accumulate in combustion chambers to form a carbonaceous layer, which then traps lead oxide resulting from combustion of the tetraethyl lead. The lead oxide de-

posited on the surface can react with hot acidic gases in combustion products to form complex mixtures of lead compounds.

Further development of the gas turbine for marine and industrial use depends to a large extent on the turbine's ability to use residual-type fuels at higher temperatures. The obstacles which must be overcome before such use is practical were described by E. B. Evans, D. H. McLean, F. R. P. Sharp, and A. Winward, all of Esso Development Co., Ltd. (England). Their paper told how the effect of vanadium in the fuel-oil ash on corrosion is modified by the presence of sulfur and sodium in the fuel and the proportion of sodium appears to affect not only the level of corrosion, but also the ease of removal of blade deposits.

How the gas turbines now in use in some segments of the oil industry are working out was outlined by Hans Pfenninger of Brown, Boveri & Co.

Operating experience is given with the Beznau (Switzerland) gas-turbine power station, the Pertigalete (Venezuela) gas-turbine plant, and the Swiss Federal Railways gas-turbine locomotive.

Two gas-turbine plants installed by petroleum companies are dealt with in some detail. One of these is the Tembi power station of British Petroleum Co. in Iran. The other belongs to Arabian American Oil Co. in Saudi Arabia.

Cracked Distillate as Diesel-Fuel Component

Laboratory results which support the use of cracked distillate as a diesel-fuel component were presented by L. A. Blanc of Caterpillar Tractor Co. He described how the use of cracked distillate as a diesel-fuel component has grown steadily over the last several years. Provided that the requirements for cetane number and other physical characteristics are met, there seems to be little difficulty in getting satisfactory engine performance. Adequate lubricating-oil and oil-change practice will allow good engine life. Stability in storage and freedom from engine filter clogging can be obtained by treatment at the refinery or by use of additives now available. Additives are also available for improving the cetane number. This paper discussed some laboratory results which support the above statements.

What refiners should consider in developing improved fuels for diesel engines was outlined by A. Wilson, N. Kendall, and L. E. Lowe, of Shell Petroleum Co., Ltd. (England). They examined recent advances in diesel-engine design as related to fuels and lubricants development against the background of increased performance and application of the diesel engine. Changes in fuel requirement for the various types of diesel engine (when considered in conjunction with needs of other prime movers) could materially affect the present balance of oil-refinery operations. If optimum refinery balance is sought, fuel specifications could be affected. This must be considered in further diesel-oil development.

What the oil industry has been doing in recent years in automotive lubricating research was reviewed by G. H. Denison and F. W. Kavanagh, of California Research Corp. They told of the wealth of knowledge that the oil industry has developed on the chemistry, physics, and engineering principles involved in lubricant performance. Skillful compounding of lubricating oils has been necessary to meet the advances in internal-combustion engines and has, in fact, contributed to such advances. Contributing to development of superior lubricants are these factors: (1) development of laboratory engine test procedures for predicting field performance of lubricants, (2) evolution of quantitative scales for evaluating corrosion, wear, sludge, piston, lacquering, ring-groove deposits, etc.

Section 7—Construction Equipment; Materials; Corrosion

This section covers materials used in construction of petroleum-industry equipment and the protection of this material from corrosion.

Studies made on steels used in storage-tank construction were described by F. J. Feely, Jr., and M. S. Northup, of Esso Research & Engineering Co., Linden, N. J. Failure of two large storage tanks in England in 1952 prompted the studies. Test results so far compare well with calculated stress in the tanks at time of failure. A plan is given to allow practical application of the test results in designing tanks which are "safe" from brittle fracture.

T. J. Peake, Northern Aluminum Co., Ltd., Banbury, England, described the wide use of aluminum in the petroleum industry. Chemical and physical properties of aluminum that are of special value to the industry were given. Cost and suitability of aluminum was compared to that of steel for many industry applications.

The advantages of using corrosion inhibitors in process equipment were outlined in a paper by R. S. Baxter, H. H. Bennett, and V. W. Hatchett, all of Socony Mobil Oil Co., Inc. Use of organic film-forming inhibitors has in certain cases allowed use of mild carbon steel instead of expensive alloys. Cost of inhibition ranges from $.30 to $1.50 per 1,000 bbl. of charge. Inhibitors in general have increased equipment life, improved operation, reduced downtime, and lowered costs of cleaning and repairs.

Graphitization of steel in refining equipment was discussed by A. M. Hall of Battelle Memorial Institute. Tests show graphitization to be present in a large number of cases. But only seldom would its presence impair use of equipment. Steels having chromium were immune to graphitization. Bend tests and room-temperature tensile tests are now being made to learn more of how graphite formation changes mechanical properties of steel.

Refinery equipment containing liquid water and hydrogen sulfide may often be severely damaged by hydrogen occulsion in the steel. This damage will appear as blisters and fissures in the steel. Methods of

predicting, detecting, and preventing such attack were described by J. G. Wilson, W. A. Bonner, H. D. Burnham, and T. Skei, all of Shell Oil Co., New York. Preventive measures include expendable metallic linings, water washing to remove promoters, and use of inhibitors.

Methods of mitigating corrosion of pipelines in urban areas are given in a paper by R. F. Hadley and D. F. van de Water, Sun Pipe Line Co., Philadelphia. No evaluation of various available coatings was given. But a strong point was made that whatever coating is chosen, it should be supplemented with cathodic protection.

Even though conducting walls of a vessel are grounded electrically, there is still a danger from explosions caused by static electricity. A Klinkenberg, N. V. De Bataafsche Petroleum Maatschappij (Royal Dutch-Shell Group), presented a paper giving various ways in which charges may be built up inside a vessel. For example, high-velocity flow of gasoline into a tank may produce very high potentials. Some precautionary measures are given.

Section 8—Transport; Storage; Distribution

This section deals with storage and transportation of crude and products. Loss control, safety, and new technical developments are the theme of papers presented.

Leakage, spillage, and evaporation cost the free world about 130,000,000 bbl. of oil last year—3 per cent of its total production. J. H. McClintock, Esso Standard Oil Co., New York, outlined a program for reducing the losses. Basically the program proposed for any company consists of: (1) determining actual losses, (2) isolating these losses as to phase of operation, (3) determining cause of the loss, and (4) initiating loss-control methods wherever economically possible. Loss-control measures include use of floating-roof tanks, good pipeline design to eliminate breaks or leaks, and education of personnel to be loss conscious.

J. F. Fairlie and F. C. Lantz, Imperial Oil, Ltd., reported data listing economic and technological considerations connected with pipelines that have recently been built in Canada.

Three major methods of laying underwater pipelines were described by J. E. Green and Howard H. List, of Shell Pipe Line Corp. The methods are: (1) continuous lay-barge work, (2) welding of sections on land and floating them in position, and (3) pulling completed sections "on bottom." The authors stress that the method chosen depends on water depth, bottom conditions, marine traffic, wave size, wind conditions, etc. Also included was a discussion on trenching and backfilling for underwater lines.

Problems in designing pipelines for very viscous fluids were covered by P. E. Ford, Anglo-Iranian Oil Co., Ltd., London. Pressure drop versus throughput curves show pressure rising to a peak and then falling as throughput is increased. The peak pressure may dictate pipeline diameter to be used. Experimental data on heating of lines with internal electric heating cable were also given.

Safety in the transmission and distribution of natural gas were discussed by Franco Salimbeni, Societa Nazionale Metanodotti (SNAM), Milano. The relation between safety and a pipeline's surroundings was discussed in detail. Since hazard varies directly with pressure and inversely with distance, the author stated that these two parameters can always be varied to keep hazard from an operating gas pipeline within admissable limits.

Section 9—Economics and Statistics

On "Interdependence as the Foundation for World Oil Operations," Walter J. Levy, economic consultant, New York, told the W.P.C. that in the oil industry as a whole, world wide, there has been an unprecedented performance by all participants. In fact, the oil companies have been able to make a unique contribution to the prosperity and security of all members of the peace-loving world by assuring a continuous expanding production, furnishing large revenues to producing countries, and providing uninterrupted access to supplies and markets through all contingencies.

Effective statistical analyses can be valuable tools for management. R. J. Gonzalez, Humble Oil & Refining Co., Houston, said that properly organized and analyzed statistics can provide the basis for better decisions on many complex problems. Analyses prepared for management should be designed to present the essential points quickly. A brief introduction should summarize the problem and the conclusions.

Systematic application of statistical analysis to the study of oil problems is a relatively new development, and a wide scope of opportunity remains for extending and improving such work. How much can be accomplished will depend on the imagination and skill of the specialists in this field.

On "Education for Management in the Petroleum Industry," W. B. Maloney, Standard Oil Co. (N. J.), said the prime essentials of a manager's job is to get things done through people. The petroleum industry is especially alert to this need because of the size of investment per employe as compared with other major industries. The understanding of human relations looms as the largest educational need for future management. Over 30 colleges and universities in the United States are featuring this aspect in their advanced management courses.

Management development consists of two essential parts—selection and training. Selection methods are being studied and will be improved. Training objectives must give those selected, the opportunities for self-education by doing.

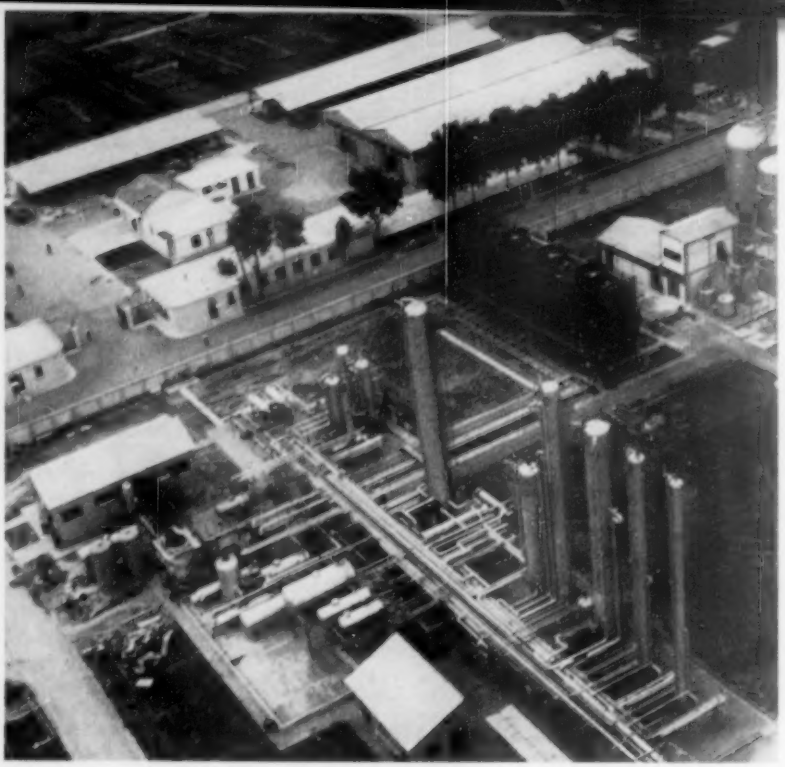
On "Utilization of Petroleum Fuels in Europe," W. M. Holaday and R. E. Albright (Socony Mobil Oil Co., Inc., New York City), reported:

Demand for petroleum fuels can be expected to continue increasing at an average rate of about 5 to 6 per cent per year. The demand will be met by European refineries. Gasoline as a percentage of total petroleum fuels will probably increase from its present level of 32 per cent. Gasoline quality will increase. Diesel-fuel consumption will continue to grow. Residual fuel use will remain higher than the United States figure of 24 per cent because of the limited availability of natural gas in Europe.

What you ought to know about

ITALY'S OIL and GAS

Here is how four authors view the current oil picture in Italy. Producing activities are centered largely on natural gas, as told in the article starting on this page. Other articles discuss production and refining, exploration, and how the nation has progressed, oilwise, the past quarter century.



Cortemaggiore gasoline plant which processes 100 M.M.c.f. per day of wet gas from the wells of this field.

Natural Gas Up Nearly

Production at war's end was 1,500 M.M.c.f. This

by Lorenzo Goffredo

PRODUCTION of natural gas in Italy has skyrocketed from 1,500 M.M.c.f. in 1945 to an estimated 120,000 M.M.c.f. in 1955. And it is expected to reach 140,000 M.M.c.f. in 1956.

In the same period of time, natural gas' share in supplying the energy consumed by Italy's growing needs has risen from slightly more than zero to more than 10 per cent.

This rapid emergence of natural gas as an important source of Italy's energy needs can largely be credited to one source—AGIP, an Italian petroleum company. Its active exploration and development work in all parts of Italy since 1926 are reflected in the many recent discoveries that have made the spectacular production advance possible.

Almost 90 per cent of the natural gas produced and distributed in Italy belongs to the societies of the Ente Nazionale Indrocarburi, a government-owned holding company. This company controls and regulates the activities of the various societies that conduct Italy's exploration, production, refining, and distribution activities.

In January 1955, this government company sold 11,400 M.M.c.f. of natural gas—19 per cent more than its January 1954 total. Its share of the total Italian production of natural gas can be seen in Table 1.

TABLE 1—ITALIAN PRODUCTION OF NATURAL GAS
(In millions of cubic feet)

	1953	1954	Per cent increase
Total	81,116	104,745	30
Ente Nazionale Idrocarburi	71,356	95,237	34
Per cent ENI	88	90.9	

Gas is replacing coal . . . The total availability of natural gas in Italy is roughly 420 M.M.c.f.d.—the calorific equivalent of 18,000 metric tons of coal or 12,000 metric tons of fuel oil. The rate at which this natural-gas energy is replacing imported coal and water

Author is with AGIPAS, Milan, Italy. Grateful acknowledgment is made to Ing. Enrico Mattei, president of Ente Nazionale Idrocarburi, and to his report to the Politecnico of Milan.

Italy's natural-gas resources are especially valuable because they are produced so close to point of use.

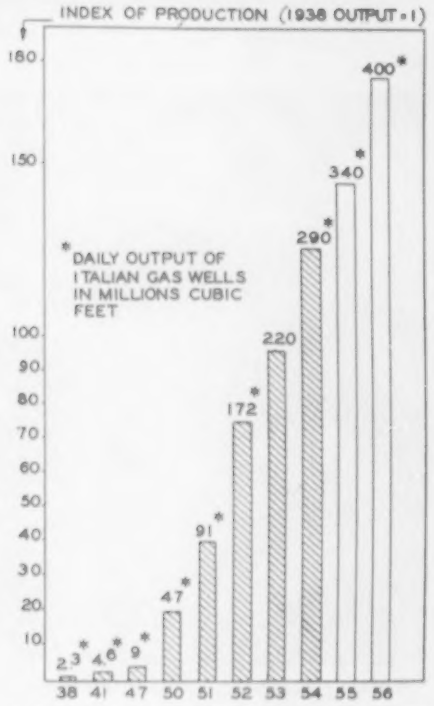


Chart shows the spectacular increase in natural gas in Italy in less than 20 years.

800 Per Cent in 10 Years

year it is estimated output will be 120,000 M.M.c.f.

power can be seen in Table 2. Notice how oil and gas energy consumption has risen from slightly less than a third of the total in 1951 to almost half in 1954.

As a result of this increase in Italy's natural-gas utilization, less and less coal is being imported each year. Natural gas now supplies two-thirds of the energy that Italian industry used to derive exclusively from imported coal. To the Italian economy, this has meant a saving of some $70,000,000 in 1954 alone. This saving is expected to be doubled in coming years as more of the growing Italian natural-gas supply is utilized.

Natural-gas sources and transportation . . . The bulk of Italy's natural-gas production comes from fields in the Po Valley of northern Italy. This gas is very high quality and very low in sulfur content. Its mean composition by volume runs 95 to 98 per cent methane, 0.5 to 4 per cent ethane, 0.1 to 3 per cent propane and butane plus, and 0.2 to 1.5 per cent inerts (nitrogen, oxygen, and carbon dioxide). Some fields outside the Po Valley produce gas with greater quantities of noncombustible gases, but no Italian fields produce gas of such high sulfur content that it is commercially unsuitable.

Italy's natural-gas resources are especially valuable because they are produced relatively close to their point of use. Natural-gas fields have been discovered in many areas of high population density, and the nearness of gas supply to the industrial centers of northern Italy has greatly helped speed its use as an industrial fuel.

TABLE 2—ENERGY CONSUMPTION IN ITALY
(Thousands of metric tons of 13,500 B.t.u. per lb. coal equivalent)

Source—	1951		1952		1953		1954	
	Amount	Per cent	Amount	Per cent	Amount	Per cent	Amount	Per cent
Coal	11,116	33	10,873	31	10,639	27	10,189	26
Electric power	11,429	34	11,863	33	12,216	31	13,481	31
Natural gas	1,420	4	2,131	6	3,369	8	6,615	10
Petroleum	9,749	29	10,850	30	13,571	34	15,371	35

Gas No Newcomer

NATURAL gas is no newcomer to Italy, even though it came into wide use as a fuel in that nation only recently.

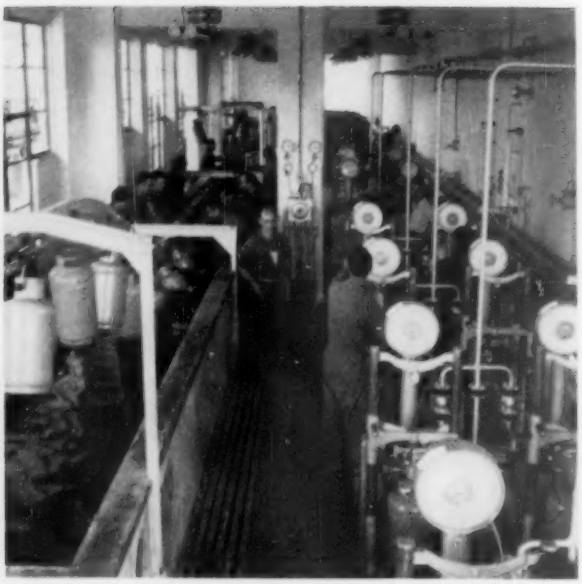
Since the time of the ancient Romans, gas made its presence manifest in many parts of Italy. Several early Roman writers described the "wonders" of the flaming seeps at various locations. But it was not until the end of the eighteenth century that such Italian scientists as Galvani Spallanzani, and Volta accurately identified these "wonders" as gas seeps.

It was World War II and the heavy strain it placed on fuel supplies that forced Italians to turn to natural gas as an important fuel source. The acute gasoline and oil shortage created by heavy military demand left the man in the street without fuel for his car, his home, or his work place. So when methane was hurriedly produced in commercial quantities to ease the fuel shortage, it won quick acceptance.

Italian consumption of natural gas for fuel climbed steadily through the war years. And it has continued to climb—at an increasingly rapid pace—in the postwar years.

Fuel-poor Italy, forced for decades to import most of the fuel that powered her industries and ran her transportation vehicles, is at last beginning to make use of the "wonders" of her natural-gas resources.

Storage tanks and tank cars in an L.P.G. plant in South Italy.



Filling L.P.G. cylinders using photoelectric automatic scales.

This nearness of the wellhead to users has also made transportation an easy job. Much of the Po Valley gas in the north is transported throughout Italy by a 3,000-mile pipeline system. Built and owned by SNAM, a government company, this network has a capacity of 700 M.M.c.f.d.

A sizable amount of Italy's gas production is transported by steel pressure cylinders for use as motor fuel. Almost a fourth of the nation's industrial trucks and other vehicles operate on natural gas. Last year, this usage accounted for some 6,500 M.M.c.f. of the nation's gas consumption. Table 3 lists the number of industrial vehicles operated by natural gas and gasoline respectively in various zones of Italy.

As the gas fields are further developed and new transportation facilities are added, the market for natural gas in Italy is sure to broaden. Even now in some towns in northern Italy, natural gas has entirely replaced coal and manufactured gas as a public-utility fuel. And in other towns it is being used for peak shaving as a supplement for coal gases.

The use of natural gas for domestic cooking and heating is blocked to some extent by the uneven demand that exists between winter and summer. For this reason, the utilities in small towns are somewhat reluctant to market the gas. But consumer interest is very high and the government distribution societies are devoting extensive study to methods that will allow these small-town utilities to economically fill consumer demand for more gas.

Petrochemical manufacturing in recent years has steadily been increasing its share of natural gas consumed. This share rose from 4 per cent of total consumption in 1953 to 7 per cent in 1954. The biggest user of natural gas for this purpose is the Montecatini, one of Italy's two major chemical concerns. This concern operates two modern plants for the production of nitrogen fertilizers—one at Ferrara and the other at Novara. The Ferrara plant uses some 7,000 M.M.c.f. of gas yearly to produce such products as ammonium sulfate, ammonia, calcium and sodium nitrates, and phosphate fertilizers.

This use of natural gas for petrochemical manufacturing is sure to increase considerably in the years ahead because two large new plants are being planned at this time. ENI, through its subsidiary company ANIC, will soon build a large plant for the production of synthetic rubber and nitrogen fertilizers. The plant will be located close to the recently discovered gas fields at Ravenna.

The other new plant, recently announced to the press, will be built jointly by ENI and Union Carbide & Carbon Co. It will have a production capacity of 30,000 metric tons per year of GR-S synthetic rubber and 350,000 metric tons per year of azotates. This plant is expected to cost roughly $75,000,000.

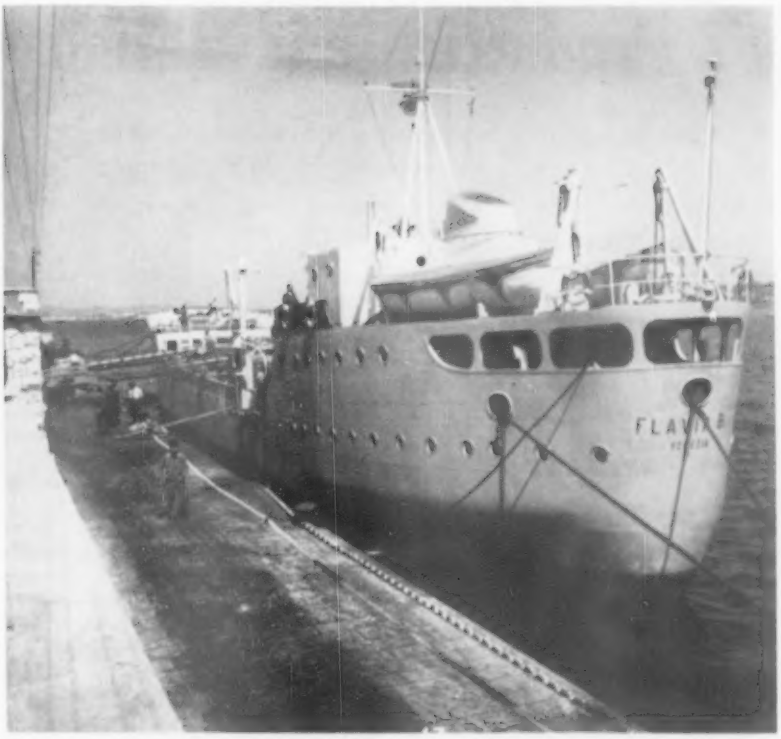
L.P.G. production . . . The rise of

TABLE 4—MARKETED PRODUCTION OF NATURAL GAS IN ITALY IN 1954
(Millions of cubic feet)

Type of industry	Cubic feet × 10^6	Per cent of total
Mining	367	0.3
Food	3,784	3.6
Textiles	10,253	9.9
Paper	3,215	3.1
Metallurgical	17,659	17.0
Mechanical	7,357	7.1
Nonmetallic minerals	7,635	7.3
Chemical:		
Thermal use	13,258	12.8
Synthesis	7,230	7.1
Rubber	2,308	2.2
Electric power	14,135	13.6
Domestic use	8,457	8.2
Motor fuel	6,532	6.3
Others	1,540	1.5
Total	103,730	100.0

TABLE 3—INDUSTRIAL VEHICLES IN ITALY SUPPLIED WITH GASOLINE AND NATURAL GAS

Area—	Gasoline	Natural gas	Natural gas (per cent)
North Italy	103,582	33,211	32.1
Center Italy	30,402	3,256	10.7
South Italy	8,542	175	2.0
Total	142,526	36,642	25.7



L.P.G. transport, equipped with tanks, cylinders, and filling apparatus. It serves one of the islands from Naples or Leghorn.

Italy's L.P.G. industry has closely paralleled this rapid growth in the natural-gas and petroleum industries. Propane and butane were first marketed in Italy in 1936 under the name of "liquid gas." But it has only been in the last 5 years that they have received wide public acceptance. This trend in L.P.G. consumption can be seen in the figures in Table 5.

The fairly large percentage of L.P.G. that Italy now imports is expected to dwindle quickly as Italy's small refineries increase their facilities for producing and storing L.P.G. Right now, France and the Netherlands provide the bulk of the L.P.G. that Italy imports.

Where L.P.G. is used . . . Domestic cooking and water heating is by far the predominant end use of L.P.G. in Italy. At the present time, more than 4 million Italians—fully 10 per cent of the population—are using L.P.G. for cooking and water heating. Their consumption total accounts for 95 per cent of total over-all L.P.G. consumption, with industry using the remaining 5 per cent.

This fairly widespread use of L.P.G. in the Italian home is due in large part to the efficient marketing system that the government has set up. L.P.G. dealers can be found in almost every small Italian town, and their ratio to the total population is almost one dealer to each 1,000 people.

The L.P.G. marketing pattern in Italy is much the same as that in the United States. Distribution companies have large storage and filling plants scattered about the country. These plants are supplied largely by pressurized tank cars, but pipelines are used whenever permitted by the nearness of refineries. L.P.G. is marketed from these plants to local dealers in cylinders, which the dealers in turn distribute to the end user.

TABLE 5—L.P. GAS MARKET IN ITALY
(In millions of pounds)

Year	Produced	Imported	Consumption	Increase (per cent)
1948	3,269		3,269	
1949	9,484		9,484	194
1950	34,348	21,571	55,919	525
1951	87,808	64,356	152,165	168
1952	144,766	14,206	265,973	75
1953	252,335	152,684	405,020	52
1954	343,228	146,777	490,006	20

One factor behind the relatively wide use of L.P.G. for domestic use is the Italian law that permits placement of L.P.G. tanks inside the home. This law is contrary to French and United States laws that require outside installation of all tanks. In defense of their less-rigorous law, Italians point to the accident record involving L.P.G.—only one accident per each 100,000 cylinders used. This record has been made possible by the extensive efforts that distributors have made to teach safe L.P.G. handling methods to the consumer. Booklets, circulars, free training courses, and educational demonstrations have helped a great deal to teach the public the safety requirements of keeping L.P.G. cylinders inside the home.

One restraining factor on greater domestic use of L.P.G. is its relatively high cost. This has served to restrict L.P.G. use to cooking and water-heating use and limited its extension to space heating. As a result, the wintertime to summertime ratio of L.P.G. use is only 2 to 1.

Industrial L.P.G. uses . . . The main uses of L.P.G. in Italian industry today are in hand and machine metal cutting, welding, brazing, annealing, and hardening and heat-treating of metals in special atmosphere furnaces. The ceramics, textile, and metallurgical industries also use propane as fuel for various purposes.

The use of L.P.G. as an industrial motor fuel is still in the experimental stage in Italy. But once this develops, its use is expected to spread rapidly and so multiply the present industrial consumption rate of L.P.G.

The outlook . . . The same forces that have contributed so much to the rapid postwar growth of Italy's natural gas and L.P.G. consumption will undoubtedly continue to keep these industries growing rapidly in the years ahead. Increased supplies of natural gas should be available to meet this increasing demand because exploration and development are constantly being expanded. And the Italian Government—anxious to raise the living standards of the people, encourage the development of industry and achieve greater economic independence — will continue to push the use of natural gas and L.P.G. products, Italy's long-overlooked resources.

A Look at Italy's Production and Refining

The most serious problem of the Italian refining industry is overexpansion of basic crude capacity, which is more than twice the consumption in the country

by Dr. Alberto Girelli

PRODUCTION activity in Italy centers in two areas: Po River Valley in North Italy, and in Sicily. The Po Valley, most promising area in the whole country, is by law reserved to the government agency ENI (Ente Nazionale Indrocarburi) which operates through its subsidiary AGIP-Mineraria.

Drilling operations carried out by AGIP since the end of the war, though fruitful as far as natural gas is concerned, have not been so favorable for oil. The discovery at Cortemaggiore (Parma) of light crude oil in 1949 has developed into a daily production of about 1,300 bbl. But this production rate is now decreasing and no other crude discovery by AGIP has been made since.

The remainder of Italy (outside the Po Valley) is being explored by private companies as well as by AGIP. Exploration and development work has been regulated, up to now, by the mining law passed in 1927 under the Fascist government. A new law is now being prepared and will soon be introduced to the Parliament.

At the present time the law is being drafted by the parliamentary commission for industry, and nothing definite is known about its final content. But it is generally considered rather doubtful that it might be more favorable than the former law toward private companies. The trend of several members of the majority in the House and in the Senate is for keen state intervention in every step of oil operations. And the left wing is going to vote solidly against any proprivate-companies project.

This trend was confirmed recently when Petrosud (a joint enterprise of Montecatini, the leading Italian chemical company, and Gulf Oil Corp.) applied for the production concession after the discovery of crude oil at Alanno, Central Italy.

Sicily presents a different picture. Under a separate regional mining law, the government encourages both foreign and domestic private capital. Sicily's first commercial oil discovery was made late in 1953 by American International Fuel & Petroleum Co., a Gulf Oil subsidiary. The discovery has developed into the largest crude-producing field in Italy. Commercial production started late last year with the shipment of the first train of crude to the nearby refinery of RASIOM at Augusta.

The author is assistant to the director of Stazione Sperimentale per i Combustibile, a government-controlled research and testing laboratory in Milan, Italy.

Another interesting area for crude production was discovered a few months ago near Alanno, a village in the Province of Pescara (Central Italy). Rough estimates about reserves at Alanno—where tests of the first well showed a flowing daily production of 3,000 bbl. of 37.6°-A.P.I. crude—indicate perhaps several million metric tons of reserves. On April 27, a second well—500 m. from the first—hit a 240-ft.-thick pay at 2,700 ft.

In the Abruzzi region not far from the site of the recent discovery, oil has been found in small quantities since the last century. Minor production was developed by AGIP between the two world wars at Tocco Casauria. But it has since been abandoned.

Geological and geophysical evidence favors the whole area along the Adriatic Seacoast, from south of the Po River Delta down to the Abruzzi-Puglie regional boundary, and southwest of that, in the the Basilicata region. According to a recent gravimetric underwater survey, the Adriatic Sea itself, in its northern part, could be a probable oil-bearing area.

Italian Refining

The largest units of the Italian petroleum-refining industry are mostly jointly owned by Italian affiliates of large international oil companies and local groups. Partnerships have also been established between the foreign group and the ENI, through its subsidiaries AGIP and ANIC.

Standard Oil Co. (N. J.) shares ownership of Bari and Leghorn refineries with the ENI subsidiary ANIC, through the Stanic Industria Petrolifera. Royal Dutch-Shell operates through the subsidiary INPET, the refinery at La Spezia. British Petroleum Co. is a 50-50 partner with AGIP (ENI subsidiary) in the IROM refinery at Porto Marghera. Venice Socony-Vacuum operates the largest Italian refinery at Naples (72,000-bbl. per day capacity), mainly devoted to products for export. Compagnie Francaise de Petroles has recently joined as a 50-50 partner in the Aquila refinery with Fiat, the car-manufacturing company. Fiat is also a 50-50 partner with Caltex in the SARPOM refinery at Trecate (Novara) and in the Petrolcaltex (the affiliate through which products of SARPOM are put on the market). The Belgian group Petrofina has recently absorbed all the activities of the independent company, Permolio (with three refineries at Milan, Genoa, and Rome), and the small Galletti refinery at Florence.

In addition to those plants owned by the international oil companies or jointly owned by them and local interests, the Italian refining picture includes a large number of generally smaller refineries, predominantly owned by local interests.

This existence of many smaller refineries is what makes Italy's refining industry different from those of other European countries. In these other

ITALIAN OIL PRODUCTION (APRIL 1955)

Name of field and year of discovery and discoverer—	Depth range (ft.)	—No. wells— Flow.	Pump.	Prod. (bbl./day)	Geolog.
Cortemaggiore (Parma): 1949—AGIP	6,230	20	...	1,200	Mid-Mioc. sands
Ragusa (Sicily): 1953—AIFPC (Gulf)	6,000	...	6	1,400	
Alanno (Pescara): 1955—Petrosud	2,550-2,700	*2	...	2,000	Mid.-Mioc. ls.

*Production not started at April 28.

countries, operations are centered in rather few refineries owned by the international oil companies.

Even so, Italian refining capacity is mainly centered in seven of Italy's 35-odd plants. The "big seven" are: Socony-Vacuum at Naples (72,000 bbl. per day); RASIOM at Augusta, Sicily (45,000 bbl. per day); Stanic at Bari and Leghorn (45,000 bbl. per day); INPET-Shell at La Spezia (32,000 bbl. per day); IROM at Venice (45,000 bbl. per day); and Condor at Rho, near Milan (45,000 bbl. per day). These, with Aquila at Trieste and SARPOM at Trecate, account for 75 per cent of total Italian refining capacity.

ITALIAN REFINING INDUSTRY PRODUCTION[1] (METRIC TONS)

	1953	1954
Processed crude	12,842,871	16,168,641
Products distribution:		
Gasoline	2,286,682	2,805,269
Kerosine[2]	818,714	1,027,889
Gas-oil and diesel fuel	2,483,695	3,155,584
Residual fuel	5,792,527	7,221,103
Lubricating oils	99,394	131,465
Bitumens	319,104	400,889
L.P.G.	111,102	200,606
Other products, intermediates, and refinery consumption and losses	931,653	1,225,836

(1) Official data from "Unione Petrolifera," Rome. (2) Includes lamp kerosine, motor kerosine, and jet fuel.

The most serious current problem of the Italian refining industry is overexpansion of basic crude capacity. Italian refineries are able to run some 470,000 bbl. of crude daily. Domestic consumption, though continually increasing, is now about 170,000 bbl. per day. Furthermore, the pattern of products consumption differs widely from the pattern of production. The demand for products is about half the production for all products except residual fuel, which is now more and more displacing coal from industrial uses.

Yet despite the opening of new refineries in countries previously served by Italian industry, exports of finished products showed a sharp gain in 1954. In fact, the increase in exports of oil products has been above the average increase of all exports of goods and merchandise from Italy.

ITALIAN EXPORTS OF FOUR MAIN PRODUCTS (METRIC TONS)

	1953	1954
Gasoline	1,326,386	1,845,806
Kerosine and jet fuel	457,475	617,836
Gas-oil and diesel fuel	1,102,821	1,604,844
Residual fuel	2,220,608	2,360,346

Crude capacity of the Italian refin-

ITALIAN REFINING (1955)

Company, address and refinery location—	Barrels per stream day: Crude topping	Cat. cracking	Therm. operation	Special process
AGIP-Mineraria,[1] Via F. Gabba 1, Milan:				
Cortemaggiore	(2)	(2)	(2)	
A.P.I., Falconara:				
Falconara	13,500		3,000	V-3,500
AQUILA, Via Dante 5, Trieste:				
Trieste	18,000	(3)	3,500	I.
CONDOR, Cas. Post. 1258, Milan:				
Rho (Milan)	45,000	15,000		
Delle Piane:				
Genoa	1,000			
D.I.C.A., Piazza Diaz 5, Milan:				
Avenza (Carrara)	3,000			
Esso Standard Italiana, Via Assarotti 40, Genoa:				
Trieste	6,150		3,000	
Garrone, Via 20 Settembre 21, Genoa:				
Genoa	8,000		2,000	
IROM,[1] Via Barberini 67, Rome:				
Venice	35,000		10,000	I.-1,000,[4] A-250, Cat. Poly.
I.C.I.P.:				
Mantua	10,000	4,000		
I.L.S.E.A., Valmadrera (Como):				
Valmadrera (Como)	2,400			500 Catforming
I.P.L.O.M., Via Della Boccarda 2 Sarissola, Genoa:				
Sarissola (Genoa)	1,000			
Lombarda Petroli:				
Villasanta (Milan)	5,000		2,500	
Italia, Via Vaccherecia 7, Florence:				
Cremona	5,000			
N.I.I.O., Via Gonin 42, Milan:				
Milan	3,200		500	
Purfina Italiana, Corso Matteotti 10, Milan	[5]3,000			I.-350, A-1,050
Florence	3,500		600	
Genoa	11,000	1,500		[6]A-1,100
Rome	10,000	1,500		A-1,250
Petroli d'Italia, Fiorenzuola d'Arda, Piacenza:				
Fiorenzuola	6,000		2,500	
RASIOM, Via Brera 21, Milan:				
Augusta (Sicily)	44,000	[7]10,000	8,200	
ROL:				
Viguzzolo (Alessandria)	2,000			I.
Sanquirico, Via Del Politecnico 3, Milan:				
Genoa	3,000			
SAROM, Via Brera 21, Milan:				
Ravenna	13,500		2,400	
Mario Bianchi, Cologno Monzese:				
Cologno (Milan)	1,500			
SARPOM, Piazza S. Carlo 161, Turin:				
Trecate (Novara)	25,000	[8]2,880	3,150	Cat. Poly.
INPET-Shell, Piazza Della Vittoria 1, Genoa:				
La Spezia	32,000		2,800	
Societa Petrolifera Italiana:				
Fornovo (Parma)	2,500			
Socony-Vacuum Italiana, Casella Postale 1492, Genoa:				
Naples	72,000	[9]22,000	2,700	I.-400, A-300, Poly. 900
Stanic Industria Petrolifera,[1] Corso d'Italia 39A, Rome:				
Bari	45,000		4,500	A-25,000[10]
Leghorn	45,000	3,700	[8]8,900	A-6,200[10]
STOI, Via Pietro Fanfani 129, Castello, Florence:				
Florence	3,500		1,000	
Dott. G. Volpato & Co., Via Ludovico il Moro 47, Milan:				
Milan	2,100			
SARN:[1]				
Novara	3,000			
Montecatini S.p.A., Via Turati 20, Milan:				
Ferrara	5,500			

(1) Companies partly owned by Ente Nazionale Idrocarburi. (2) Under construction. (3) T.C.C. plant being erected. (4) 1,750-bbl. per day Platformer planned. (5) Additional capacity under way, with remodernization of the whole refinery. (6) 1,000-bbl. per day Platformer planned. (7) Scheduled. (8) Scheduled for 1955. (9) T.C.C. plant being erected. (10) Under construction, fluid Hydroforming unit also being erected.

Ticino River crossing of 16-in. Cortemaggiore-Torino pipeline, the longest in Europe.

ing industry stood at 1.5 million metric tons per year in 1938. The present level, close to 23 million metric tons per year, is roughly 15 times that of prewar years. It must be further borne in mind that at the end of World War II the industry was practically reduced to zero.

Hopes for continued expansion of domestic demand, well above the programs and the forecasts of the OEEC, are probably sound. The index of overall Italian industrial production is increasing. Consequently, expansion of oil-products consumption—both for industry and for related activities such as transportation—should follow.

In several manufacturing industries, there was a sharp increase in hydroelectric power demand immediately after the war. But the trend now is toward increased use of fuel oil. Food processing, glass and ceramics, iron and steel, and the chemical industries are substituting natural gas and fuel oil for coal wherever technically possible.

At the same time, the erection of new thermoelectric power plants, operating largely on fuel oil or on a dual-fuel basis (natural gas and fuel oil), will increase the consumption of residual fuel. Thermal power stations, formerly considered mainly as reserve plants to integrate hydroelectric power supply at the time of seasonal water-power shortage, are now built largely to operate full time as base-load power generators.

Residual fuels are also being employed more and more by city gas production and distribution companies in special oil-gasification units, or even to supplement coal in conventional coal-carbonization plants.

A number of refineries recently have been adding secondary-processing units for upgrading their products. Most refineries are equipped with bauxite desulfurization plants which have proved particularly useful—as well as economically convenient—for refining Middle East gasolines. Such plants in some cases are being operated in combination with thermal reforming facilities. Other refineries employ, or soon will employ, catalytic cracking units. And large and small refineries alike are paying increased attention to modern catalytic reforming for upgrading motor fuels.

Fluid Hydroforming, Platforming, Catforming, and other catalytic processes are presently operating or being installed at several Italian refineries. Reforming, at least in the near future, will be more popular than cracking processes due to the particular products demand pattern of Italy.

The demand distribution in 1954 has been as follows: gasoline 16 per cent, middle distillates 31 per cent, and residual fuel 53 per cent. Quality of marketed gasoline is very good by European standards. In 1950, regular-grade gasoline of 65 motor octane was distributed in Italy. In 1954, the average octane rating was 74-76 motor for regular grade, and 90-92 research for premium grade.

Octane requirements for both regular and premium fuels are easily met by refineries equipped with catalytic cracking and catalytic reforming facilities. Smaller refineries, lacking such plants, keep pace on regular grade only by bauxite desulfurization of low-end-point, straightrun gasoline. A typical motor fuel from a refinery of this kind processing Iraq crude has the following characteristics:

A.P.I. gravity = 70.5°.
Total sulfur = 0.02 weight per cent.
R.v.p. = 9.2 psi.

A.S.T.M.: End point = 302° F.
A.S.T.M. octane (F-2): Clear = 58.5; +1.9 ml. per U. S. gal. TEL* = 76.0.

Taxes on gasoline are very high. The price of regular gasoline from the refinery, 25 lire per liter (about 15 cents per U. S. gallon) jumps to 128 lire per liter (75 cents per U. S. gallon) after taxes at the filling station.

Premium gasoline costs 28 lire per liter at the refinery (18 cents per U. S. gallon) and 138 lire (81 cents per U. S. gallon) after taxes.

Other finished products sold on the domestic market are also heavily taxed. Special exemptions are granted to those products used for special activities, such as kerosine and diesel fuel for agricultural tractors and for commercial fishing. On the whole, however, oil products are taxed much more than coal, natural gas, and hydroelectricity. This causes a distortion in the energy-consumption pattern, and sometimes prevents the different forms of energy and the different fuels from reaching their naturally balanced price level and their optimum use.

Petrochemicals . . . Chemical production from imported crude is the newest Italian oil-industry activity. Natural gas has been the first raw material for petrochemicals used in Italy (mainly for ammonia, urea, and nitrogen fertilizers) by Montecatini since 1950. The first important operation for oil to chemicals conversion has been planned, also by Montecatini. It is partially operating while extensions are under way.

The Montecatini petrochemical works are located near Ferrara, on the eastern side of the Po Valley. They comprise two main divisions: one operating on natural gas, the other on crude oil. The latter has a 4,500-bbl. per day topping unit (whose light cuts are refined and placed on the market) from which the intermediate fractions are fed to a steam-cracking plant. This plant's producing capacity is 56 million pounds per year C_2 and C_3 olefins.

The discovery of crude in Italy by a Montecatini affiliate (Petrosud)—if developed into successful production—may give the company a particularly favorable raw material to replace the Middle East crude now used at the Ferrara works.

*Maximum allowed by Italian specifications for regular grade.

Recent Strikes Stir Oil-Finding Hopes

Sicily, the Adriatic seaboard, and the Po Valley are most promising areas

by Maurice Moyal

ON January 1, 1953, the oil reserves of Italy were put at a paltry 5 million barrels, all told. On March 31, 1955, these were reckoned at perhaps a good many more millions. How much is not known exactly because there have not yet been drilling and completions. The increase in any event is very substantial. The prolific strikes at Ragusa and Alanno which occurred in the meanwhile have contributed greatly to the dramatic alteration of the picture.

Such startling developments cannot be overestimated for Italy, hitherto deemed devoid of any appreciable mineral resources. The proper exploitation of its big latent oil wealth may mean all the difference between abject poverty and reasonable well-being for 4 million partially or totally unemployed Italian workers.

Need for expansion . . . There is much room here for a greatly-expanded production of power, for Italy in this respect is the most underdeveloped country in Western Europe. It is reckoned that the consumption of power under all its forms is twice as large per capita in France, 4 times as large in Britain, and 15 times as large in the United States.

Italy's prospective oil territory consists of three areas:

1. The southern island of Sicily, and more especially its southeastern section (proved oil bearing by Ragusa).

2. The Adriatic seaboard, in South-Central Italy, including the Marche, Puglia, Abbruzzi, and Calabria regions (proved oil bearing by Alanno).

3. The valley of the Po River in North Italy (proved oil bearing by Cortemaggiore).

Sicily . . . Oil shows were known in Sicily ever since Roman times. Twenty years ago, the 100 per cent state-owned AGIP (General Italian Petroleum Agency) started the first geophysical investigations in the island. All it had to show for its 1935-45 campaign—1 billion lire in expenditures and 45,000 ft. drilling—were a few barrels from the oil deposit at Bronte, which proved too insignificant to justify commercial exploitation, and a modest methane discovery at Gioitto, near Troiana, which has been yielding some 3,000 cu. m. per day.

The regional government of Sicily realized that the shortsighted and monopolistic mining law of Italy's central government discouraged private investors from entering into oil exploration and drilling. The law stipulates: "Whoever discovers a mineral deposit is entitled to priority *in case* (the italics are the author's) the state would grant a license to exploit it."

Grasping that precious little progress would be achieved as long as AGIP had the whole field to itself, the Sicilian Government entered on the statute book a regional law throwing the island wide open to risk capital. Under this law, the discoverer of an oil or gas deposit is automatically entitled to take out a 240-acre lease with a 20 to 30-year term. The leaseholder must pay a royalty, in kind or cash, of 4 to 20 per cent of the gross value of production. The lease covering the prolific Ragusa strike provides for a 10.5 per cent royalty, for example.

At the same time, the regional government hired two foreign outfits, the Compagnie Generale Geophysique and Askania, to carry out respectively a telluric and seismic refraction survey; the results were used to revise the 70-year-old geological map of Sicily.

Such developments induced several foreign and Italian companies to take an active interest in the exploration of Sicily. Main ones are Gulf and British Petroleum Co., which have secured extensive research permits through affiliates. Gulf thus owns 100 per cent of American International Fuel & Oil Co., and holds a 65 per cent interest in Mediterranean Oil Co., with Macmillan holding the balance. In association with Elmer Thomas, an independent American geologist, Macmillan was the first foreign company to investigate Sicily —as early as 1947—and also holds extensive permits in its own right.

Ragusa discovery . . . The first major find in Sicily was registered in an area previously explored by AGIP and given up as hopeless, on the theory that Mesozoic sediments would be entirely devoid of pay. This prolific Ragusa strike was brought in on the acreage of American International Oil & Fuel Co., which has been now turned over to Gulf Italia Co., of associated American and Italian interests.

On May 21, 1953, the discovery well was spudded on the anticline, less than 1 mile from the town of Ragusa, in the southeastern section of Sicily. Drilling was retarded by core taking, to check the depth of the strata and composition of rock layers. After cutting basaltic layers, the well hit a Mesozoic pay zone at a depth of 6,188 ft., on October 27, 1953.

The well has been producing some 800 bbl. per day of heavy, bituminous crude with 19.2° gravity, similar to some Venezuelan crude oil. Gulf has been drilling a whole series of exploration and extension wells — it will eventually take some 40 of them—to establish the boundaries of the new productive area. Additional drilling has established a gross pay thickness of around 650 ft.

In order to probe a possible extension of the field, Gulf has started to drill a fifth well on a promising structure at Giarrantano, jumping 12.5 miles from the first four holes, concentrated in a very small radius. At latest reports, this well was drilling ahead without yet finding production.

As of March 31, 1955, the Ragusa producers aggregated 2,590 bbl. per day, corresponding to a yearly production of a shade under 1 million barrels. It will be stepped up to 7.5 million barrels, taking care of 10 per cent of the country's total consumption. A storage tank has been provided in the immediate vicinity of 1 Ragusa and the crude is trucked to the RASIOM refinery at Augusta.

New activity . . . The success of Gulf has touched off a flurry of 56 applications for new permits from 7 foreign and 20 Italian companies. Most prominent of the outfits in the queue are, besides the ones quoted above, Wrightsman, Edison, Western Geophysical Co., AGIP, Montecatini, SNIA, RASIOM, ENI, and Engineer Fabrizi from Rome.

Permits covering 4,800,000 acres

have been granted or are being processed. Despite the formal complaint it has lodged with the Constitutional Court of Italy, the 100 per cent state-owned ENI failed to secure more than 11,000 acres of permits. The only regions not to have been the objects of applications are the Mesozoic ranges in the vicinity of Trapani and Palermo, and the northern chains of Madonie and Peloritano.

In the plain of Catania, the MISIO (a joint interest of EVSAVIO, AGIP, and Engineer Leonardi) brought in six exploratory wells; all of them encountered gas at 1,500-1,600 ft. Each well has been producing some 600,000 cu. ft. of natural gas per day; most of this production goes to feed the Catania thermo-electric plant of the Societa Generale Ellectrica.

In the Sciacca area, in the vicinity of Agrigento, a detailed geological and geophysical reconnaissance located a promising structure; it has been drilled with as yet unreported results.

Wrightsman failed to find production in its well drilled to 3,200 ft. in the vicinity of Montallegre. Gulf has initiated a wildcat to probe a promising structure to the west, near the town of Aragona Caldare, in the Agrigento region.

At Vitteria, some 28 miles to the west of Ragusa, the first test spudded by D'Arcy appears to be a heavy-crude discovery; further tests and studies will determine whether this strike constitutes a paying proposition.

On top of it all, the Troiana area, where a modest gas production has been found, is reckoned to be no less promising than the Ragusa area itself by some oil men.

Central Italy's possibilities . . . Besides sizable oil resources, central Italy, the second oil province, may well contain many natural-gas deposits, which could play a vital role in developing depressed south Italy. Here, three companies are submitting their concessions, covering an aggregate 968,880 acres, to stepped up scouting and drilling:

The Societa Adriatica di Ellectricita is active on its 106,500-acre concession around the town of Forli, in the Pescara Province.

On its block of leases, covering 612,224 acres in the provinces of Ancona and Acoli, the 100 per cent state-owned AGIP Mineraria spudded nine wells at Morravale, Porto San Giorgio, and Rapagnanno. From the latter location, it found a natural-gas deposit which produced some 4 million cubic meters of gas in 1954. Ever since 1941, the gas deposit at nearby Penna San Giovanni has had an output of some 500 cu. m. per day. Following a thorough geophysical reconnaissance, AGIP will soon spud its first test on a favorable structure on its Urbino concession.

On a location previously given up as hopeless by AGIP, Petrosud (in which Gulf and Italy's Montecatini own equal shares) has found at Alanno one of the most prolific fields ever discovered in Western Europe. The new productive area lies at the very heart of its concession, covering 252,480 acres around the towns of Piceno, Macerata, and Terrano, in the Province of Ascoli.

The year 1955 got off to a flying start with 1 Cigno flowing at the initial rate of 2,600 bbl. per day from a depth of only 2,200 ft. Whereas the crude in Ragusa has to be pumped some 1,200 ft., the pressure in 1 Cigno is high enough that the crude flows freely.

Steadily on the upgrade, the output of 1 Cigno reached 3,700 bbl. per day in the first week of April, corresponding to a yearly rate of 1,332,000 bbl., thus exceeding the combined output of all Ragusa producers.

The Alanno strike must remain an unknown quantity at the moment; it will take some more extension wells to ascertain the extent and value of the new field. It has been established, however, that the gross thickness of pay is about 300 ft. The crude 1 Cigno yields is light and rich in automotive gasoline.

Po Valley . . . In 1953, a law turned the Po Valley, which is Italy's third and perhaps biggest oil province, into the exclusive preserve of the 100 per cent state-owned ENI. This may well explain why those 18,000 sq. miles of country, stretching all the way from Venice to Torino, yielded in 1954 a paltry 900 bbl. per day from the 73 wells at Cortemaggiore.

And yet, many oil men consider that the Po Valley may turn out to be the biggest oil province in the whole of Western Europe.

Thanks to seismic refraction, the big methane fields here were brought into production: Caviaga (1944), Ripalta (1947), Cortemaggiore (1949), Comegliano (1950), Bordolano (1951), and Corregio (1952). The same reconnaissance method uncovered more recently Revenne, Imola, Alfonsine, and Cottignole, in the eastern section of the valley.

ENI has been stepping up the geological reconnaissance of the Neocene outcrops bordering respectively on the Appenine and Alp mountains.

According to the over-all figures released by that company, 414 seismic-crew work weeks and 58 gravimetric-crew work weeks were logged in the whole of Italy between April 30, 1953, and April 30, 1954. For the period under study, 32 medium and heavy-duty rigs brought in 103 wells, totaling 591,879 ft.; 67 wells and 345,876 ft. for exploitation and extension, and 36 wells and 246,003 ft. for exploration.

Seventy-three wells—56 in exploitation and 17 in exploration—achieved positive results. The fact that 47 per cent of the exploration wells found production shows the value of the geological and geophysical reconnaissance on which they had been located.

Twenty-Five Years of Progress

by Dr. Francesco Zurlini

IN 1928 Italy consumed only about 1,100,000 tons of petroleum products. This amounted to about 27 kg. (59.4 lb.) per capita. Almost all of these products were imported. The contribution made by the two small refineries at Fiume and Trieste, which became Italian at the end of World War I, was negligible. The other refineries, even smaller, were set up to refine the small quantity of crude produced in Italy.

In 1954 Italian oil consumption had grown to over 8,300,000 tons (180 kg. per capita). Almost this entire quantity was processed by Italian refineries, only 6 per cent being imported. In addition, the country exported more than 7,200,000 tons of refined products and fuel oil, chiefly to various European and Western Hemisphere countries.

These few figures present a graphic account of Italy's progress in petroleum during the past quarter century. The increased consumption has been brought about by progress in industrialization, and has resulted in a refinery system that ranks only behind those in England and France in all of Europe in capacity.

Italy still remains completely dependent on foreign countries for its crude-oil supply; its current annual production of about 76,000 tons is negligible.

The author is associated with Unione Petrolifera, Rome, Italy.

But if research now in progress in various parts of the peninsula and Sicily confirms in the next few years the findings already made — which thus gives reason to hope for the future—even this fundamental problem of the Italian oil economy can be considered favorably resolved.

An outstanding success has been obtained, in the meantime, with the discovery and exploitation of reservoirs of natural gas in the Po Valley. In 1954 these furnished almost 3 billion cubic meters of methane gas, corresponding to about 4 million tons of coal (more than 30 per cent of the Italian demand for this fuel).

Today there are 34 Italian refineries. These are located in every part of Italy, and have an annual capacity exceeding 23 million tons. Among these refineries nine have a combined capacity of more than 17 million tons.

This impressive network of plants was started in 1929 when, taking advantage of a customs tariff very favorable to production of gasoline in Italy, the first thermal cracking plants were built at La Spezia, Naples, and Venice. During 4 years (1930-33) these three plants refined in total more than 1 million tons of fuel oil, thus providing a considerable part of gasoline consumption.

However, the tariff advantage lasted a relatively short time. After a few years the government reduced the customs duties on gasoline to approximately one-seventh of the previous one, thus almost annulling the favorable condition which had encouraged the building of cracking plants.

Almost at the same time in late 1933, as the result of years of study and discussion, a new Italian oil law was passed. This has remained in force ever since. The principal purpose of this fundamental law was to encourage and make possible—according to an economic plan well-balanced in relation to the country's needs — the installation and operation of refineries capable of producing all the various oil products necessary to Italian economy.

Before World War II such an aim had almost been reached. In 1939 there were seven refineries of medium size in operation in Italy, with a combined capacity of over 2 million tons, plus seven other small plants which could refine approximately 300,000 tons.

In 1939 the yield of refined products and fuel oil was over 1,700,000 tons, obtained completely from imported crude petroleum. Since, in ths same year, consumption was less than 2,200,000 tons, Italian refineries therefore had supplied more than 70 per cent of consumption in the year before the war.

War struck savagely at the Italian oil industry. All the plants (with the exception of the Bari plant, miraculously untouched) were damaged: some were completely destroyed, others damaged in less, but nevertheless serious degree.

With the resumption of peace, the first work of reconstruction was begun by CIP (Italian Oil Committee; this body was originally established by Allied authorities and subsequently recognized by the Italian Government). Besides taking care of the procurements and distribution of oil products needed by the country, it provided for rebuilding storage and distribution equipment, as well as refineries destroyed or damaged during the war.

Rate of Growth

Since 1949, private enterprise of both old and new gas companies, and of national or foreign capital, have given a large additional impulse to the strengthening of our industry. This impressive recovery can be deduced from the following figures:

Year—	Refining capacity	1938 year index equal to 100	Subsequent percentage increase
1938	2,300,000	100	
1948	2,500,000	109	8.69
1950	6,500,000	283	160.—
1951	9,500,000	413	46.15
1952	13,100,000	569	37.89
1953	20,900,000	909	59.54
1954	22,500,000	978	7.66

Taking into consideration last year, and referring to 1938 as basic year, the increase in other Western European countries has been as follows:

	Index
France	356
Germany	353
Holland	967
United Kingdom	847

Therefore, Italy holds first place in the increase of European oil industry, with her index of 978.

The development of refinery capacity in Italy, which occurred in such a large measure after the war, is closely connected with Italy's favorable geographic position in relation to the new crude petroleum resources discovered and exploited in the Middle East.

Italy's position has resulted in continually increasing exploration by Italian refineries. In 1954 it surpassed 7,300,000 tons of exported products.

Taking into consideration 1949 as basic year, and 100 as index of quantities exported in that year, the relative export position in 1954 of the principal Western European countries was as follows:

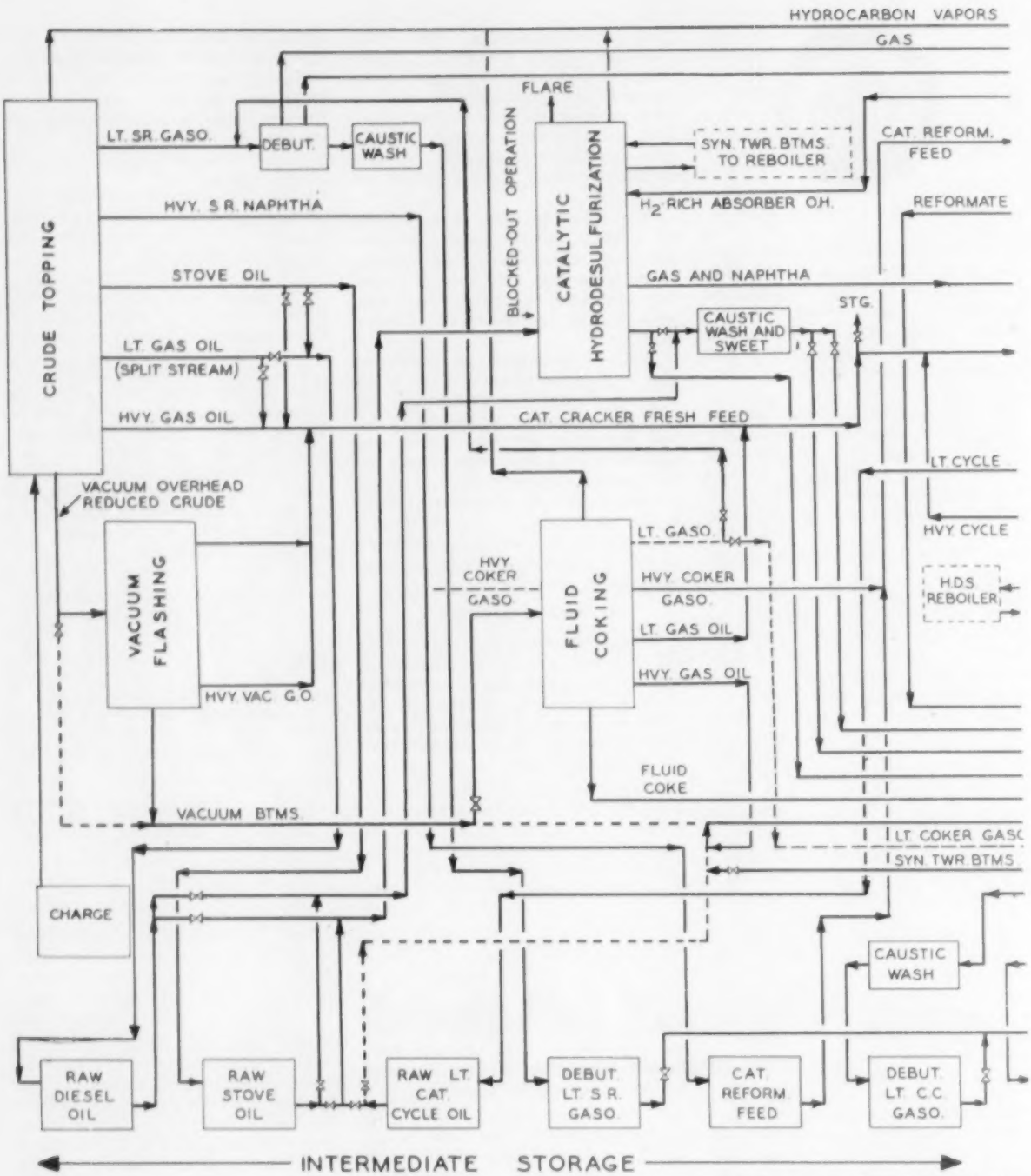
	Index
France	284
Germany	596
Italy	2,602
Holland	591
United Kingdom	2,252

It is true that these indexes, and those already mentioned, cannot be considered as absolute values, since the starting position of the various countries was different during the base year. However, the increase which resulted from the refinery capacity, and the exportation activity of Italian refineries are worthy of the greatest consideration, comparisons aside.

The export activity is due entirely to the enterprise of Italian refineries. In fact, our government has never facilitated this activity, and has hitherto refused to relieve it of fiscal taxes which do not affect other European industries, but are in force in Italy.

The same spirit of enterprise, organization ability, and willingness to work have been demonstrated in the commercial field. Italy today has a rich chain of coastal and inland deposits, and a perfected organization for distribution. There are more than 37,000 distributors, and 6,000 gasoline stands and service stations. This means that in every small and large center, and on each Italian road, there are adequate supplies of good petroleum products. The distribution system is similar, if not superior, to that of other European nations more economically advanced than Italy.

Therefore, Italy can be grateful to all those persons—shareholders, managers, employes and workmen — who have given their intelligent contribution, who have worked long and hard in the creation of an industry that honors our country, and that is recognized throughout the world for its technical quality.



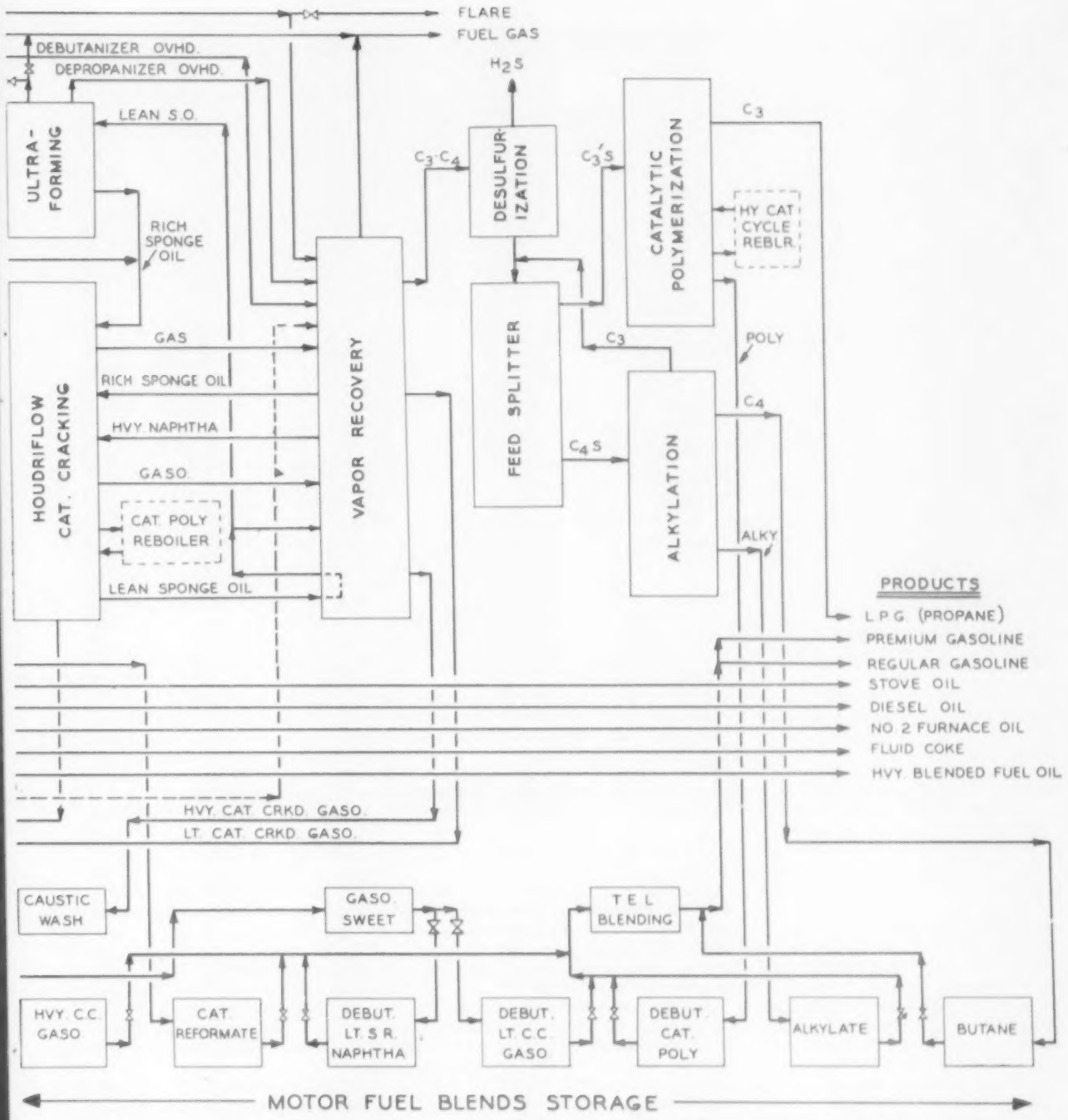
Modern Combination Processing

. . . at new Canadian Petrofina Refinery

by George Weber
Refining Editor

THE concept of combination processing will be brought to a new advanced stage in a refinery now being built by Canadian Petrofina, Ltd., at Montreal, Que., Canada.

This 20,000-bbl. per day plant incorporating five catalytic processes will carry petroleum conversion to a new high level. It will be capable of producing a maximum yield of high-quality light and middle distillates and the gasoline octane potential will equal or exceed that of any refinery existing today.



While processing will be closely integrated to provide heat efficiency and to reduce investment in intermediate storage, pumps, etc., the refinery will still retain a degree of flexibility which will permit processing variations to meet seasonal market fluctuations.

Alternate processing is provided for some crude fractions, and most major processing units can be turned around without seriously affecting other operations.

Background . . . Canadian Petrofina represents the first Western Hemisphere operation of the parent company, Compagnie Financiere Belge des Petroles of Brussels, Belgium, known to the industry as "Petrofina." The new Canadian venture was organized at the end of 1953 with 25 million dollars in new financing.

With a cadre of administrative, manufacturing and marketing personnel headed by A. F. Campo, executive vice president, the company proceeded to organize marketing facilities and plan a complete new refinery to process imported crude. Construction contracts for the new plant were awarded last spring to Canadian Kellogg Co., Ltd., and Lummus Co. The refinery is scheduled to go on stream during the last half of 1955.

Combination Design

The accompanying schematic flow chart illustrates the close integration of processes which represent the latest advances in petroleum conversion. As a result, during normal operations, the refinery will utilize only six interme-

diate process storage tanks, of which five are necessary to permit blocked-out operation of treating and desulfurizing facilities.

The catalytic Hydrodesulfurizer will operate alternately on diesel oil, stove oil, and light catalytic cycle stock, and the gasoline sweetening unit will process both straightrun and catalytic stocks.

The direct transfer of hot streams from one process unit to another permits heat economy and reduces the investment in heating facilities. Additional B.t.u. saving will be realized through the use of heavy catalytic cycle stocks as a source of reboiler heat in the desulfurizing and polymerization units. During turnaround of the catalytic cracking unit a heavy vacuum distillate stream can provide substitute reboiler heat to these units.

Further economies in maintenance result from the elimination of intermediate storage. Except when properly blanketed, these intermediate streams can become partially oxidized when run temporarily to storage tanks. When such streams are reheated for catalytic cracking or other processing, they tend to show higher deposition rates on heat-exchanger tubes and other surfaces, thus increasing the maintenance load in a refinery.

First of its kind . . . The Petrofina refinery is unique in bringing together for the first time a combination of a vacuum distillation and fluid coking with five catalytic processes, namely, cracking, reforming, hydrodesulfurization, polymerization, and alkylation.

The catalytic cracking operation permits of considerable flexibility. The bulk of fresh feed comprises the heavy atmospheric gas-oil and vacuum gas-oil streams. Additional straightrun feed stocks in the form of light gas oil and even stove oil can be diverted to catalytic cracking. The light atmospheric gas-oil stream will normally be split between diesel fuel and catalytic feed, in proportions necessary to supply seasonal demand for the former.

In addition to the virgin feed stocks, the catalytic cracking unit will process a thermally cracked light gas oil from the fluid coking unit. Heavy catalytic gas oil will be cycled to extinction while light cycle stock will normally be withdrawn as No. 2 furnace oil.

Cat reformer . . . Catalytic reformer feed will comprise heavy straightrun naphtha, plus about 10 per cent of heavy coker gasoline. The net hydrogen produced in this unit will be utilized directly in the catalytic hydrogenation unit for converting sulfur compounds in middle distillate fractions to hydrogen sulfide. The desulfurizer will also produce a small volume of gas and gasoline which is commingled with cat cracked gasoline in the vapor-recovery unit.

The vapor-recovery unit serves the entire refinery, receiving light hydrocarbons from the topping, coking, cracking, reforming, and desulfurizing units. By use of sponge or absorber-oil circulation, efficient recovery of light ends is effected for maximum utilization of C_3 and C_4 hydrocarbons in the polymerization and alkylation units. These last two units are designed for excess capacity at normal initial operating schedules, to provide a cushion for future operations at higher conversion levels.

High Distillate Yields

Under normal operations, the new refinery is capable of a daily output of about 11,500 bbl. of total gasoline which represents 58 per cent on crude. Not only is this a particularly high gasoline yield, but the hydrocarbon octane of the gasoline pool will be substantially higher than the average for Canadian or United States plants.

Gasoline pool . . . The gasoline pool will comprise about 14.5 per cent light virgin gasoline, the only unconverted component separated from the original Kuwait crude. Catalytic gasoline, including some coker product, will represent about 43.5 per cent of the gasoline pool and catalytic reformate will contribute 23.5 per cent.

The remaining components include about 6 per cent of butane for volatility, plus the very high octane polymer running a little over 2 per cent, and alkylate which will represent nearly 10 per cent of total gasoline production.

Petrofina plans to make no aviation gasoline. Hence it will have a substantial production of alkylate either for sale or for blending to make a clean-burning, high-octane motor fuel low in tetraethyl lead dosage.

Assuming that the refinery were to be operated for maximum octane, it could theoretically produce a gasoline pool of between 98 and 99 research octane number with tetraethyl lead. This is believed to represent the highest octane potential for total gasoline pool of any refinery existing today.

Middle distillates . . . Although the kerosine and light-gas-oil side streams from the crude-topping unit will normally find end use as stove oil and diesel fuel, they can be diverted wholly or in part to catalytic cracking. Normally, the refinery will produce a stove-oil yield of about 11.3 per cent on crude. Light gas oil if withdrawn entirely for diesel fuel will run about 8.7 per cent on crude.

Light catalytic cycle stock when desulfurized will produce No. 2 furnace oil, representing about 11 per cent of crude charge. These three middle distillates will aggregate a maximum of nearly 31 per cent on crude.

In conventional operation, with the fluid coking unit charging all vacuum bottoms, the refinery will produce a total heavy fuel yield of about 6 per cent, comprising heavy coker gas oil and synthetic tower bottoms from the catalytic cracking unit. Net fluid coke production will average about 135 tons per day.

Units and Licensors

Canadian Kellogg was awarded the contract for construction of the 20,000-bbl. per day topping unit, the 10,000-bbl. per day vacuum units and the coking, catalytic reforming, polymerization, and alkylation facilities. Lummus is building the catalytic cracking unit, the catalytic desulfurizer, and vapor-recovery facilities.

The fluid coking unit, capable of charging 3,800 bbl. per day, is licensed by Standard Oil Development Co. The catalytic Hydrodesulfurization unit, capable of processing 3,000 bbl. per day of stove oil, diesel fuel, or light cat cycle stock is licensed by the Royal Dutch-Shell group.

The Ultraforming unit, capable of upgrading 3,600 bbl. per day of naphtha charge, is a development of Standard Oil Co. (Indiana), licensor. Houdry Process Corp. developed and license the Houdriflow catalytic cracking unit which is rated at 10,000 bbl. per day fresh feed plus 6,000 bbl. per day of recycle.

The vapor-recovery unit is of Lummus design and the sulfuric acid alkylation process is a development of M. W. Kellogg Co. Universal Oil Products Co. is licensor of the catalytic polymerization process.

Primary contractor for extensive offsite facilities is Canadian Kellogg which is subcontracting some work. Principal nonprocessing facilities include a steam plant, a TEL blending unit, an effluent disposal plant, cooling tower, and tank farm.

Refinery pipeline systems will provide refinery gas for fuel, process and power steam, compressed air, and water. The refinery will maintain its own wharf facilities for loading and unloading ocean-going tankers and barges. At the loading racks for trucks and tank cars, paved areas will be equipped with heating coils for snow removal.

Plant buildings will comprise an administration building, a laboratory, a maintenance shop and warehouse, a change house and a gate house. A larger administration building will serve the marketing division of the new Canadian company.

ORIGINAL PRODUCTS LINE laid close to the railroad tracks being inspected prior to removal in connection with revamping the system.

SCUFFING SLEEVE pulled by winch line from truck seen in the rear. Coating materials are peeling off at the front edge of the sleeve.

Unused and Unusable Pipeline Rebuilt

Here's the story of one pipeline that wouldn't work—until it was relaid according to established good practices. Originally laid aboveground close to a railroad the line was damaged several times by train derailments. It was later moved away from the railroad in most places and buried deep where it had to go along the railroad. The case points up the need for using good engineering and construction methods in pipelining.

by Paul Reed
Pipeline Editor

THE importance of competent design and construction is strikingly exemplified in the case of Antioquia Railroad's pipeline in Colombia. This products system is a pioneer venture in pipelining as a railroad undertaking. Such pipelining by railroads is still rare in the world. Information for this article was obtained from several sources since the status of the project and the methods used have been widely known and publicized in the area.

Because this system was entirely unworkable when finished, it had to be rebuilt from end to end before it could function at all.

The Antioquia system is a 6⅝-in.-diameter, 0.188-in.-wall, 111-mile products pipeline from Puerto Berrio on the upper Magdalena River to the Medellin industrial center. The pipeline traverses rugged mountainous terrain. Elevations are 400 ft. at Puerto Berrio, 5,100 ft. at the highest point on the line, and 4,800 ft. at the Medellin delivery terminal.

Because of the steepness of the three river valleys through which the railroad goes, about half of it is built on side-hill cuts. At Cisneros the railroad runs through a tunnel. But the line was originally and finally located on a route passing over the mountain. An early proposal to put the pipeline in the tunnel was discarded.

The project is an undertaking of the Antioquia Railroad, owned by the State of Antioquia. All financing has been done with Colombian capital.

Unfortunately the original line constructed in the 1950-52 period was designed and built by a firm which did not follow familiar pipeline practices and which did not plan for meeting the obvious requirements of climate and terrain. When completed, the line was found to be so unsafe that it was impractical to operate.

After a complete change in the management of the Antioquia Railroad, Williams Brothers Co. was engaged to make an engineering study and to proceed with revamping the pipeline throughout.

The work of entirely relaying and recoating the line and changing facilities at the pump stations was begun in May 1954 and the first movements of products began in February 1955.

The labor cost of revamping the system was greater than that of build-

ing a new line, but the total cost of revamping was less than that of building a new system because pipe and equipment were already available on location.

When Williams Brothers went out to look at the pipeline, they found it in the following condition:

1. The line had been laid on the ground close to the tracks of the Antioquia Railroad.

2. From end to end, it was filled with water intended for hydraulic testing. (No products had been put in the line.)

3. Already the line had been punctured by several train derailments. (Normally there are more than a hundred derailments per year on the Antioquia Railroad.)

4. No deliveries of anything had been made anywhere.

An engineering survey showed that most of the line could be located on top of the ground at a considerable distance from the railroad. It was clear that the remainder had to be buried with 30-in. cover close to the railroad at narrow places on mountain sides.

In relaying the line, 90 per cent of the pipe was laid on the ground away from the railroad—as far as half a mile in some cases; and 10 per cent was buried at the edge of the berm or close to the railroad.

The engineering study also covered the revamping of stations and terminals. Open wiring and lighting fixtures were fire hazards which called for enclosed installations in accordance with customary safe practices.

Manifolds originally placed in the station buildings needed to be cut, removed, enlarged, and rebuilt outside in order to provide safe conditions for future replacements or expansion.

For safety and control, the stations were given mercury switches, pressure regulating valves, and pneumatic control.

Each of the two pump stations at Caracoli and Cisneros has two 3-by-10 double-acting piston pumps, each driven by a 120-hp. diesel engine.

Throughput is 8,000 bbl. per day of motor gasoline. The line transports four products—motor fuel, aviation gasoline, kerosine, and diesel oil.

Communication is by radio for voice and teletype.

Pipe cleaning . . . Since the pipe had been originally coated with a low-melting-point asphalt, it was necessary to entirely remove the old coating and recoat with materials suitable for a tropical climate. To do this, a program was set up for removing all the pipe and running it through yard equipment to scrape off the old coating and apply the new.

In the takeup operations, the pipe was cut in sections averaging 45 to 50 ft. in length. Some sections were cut as long as 100 ft. Originally the pipe had been delivered to the project in 40-ft. lengths.

STRAIGHTENING PIPE with a bending shoe at the base of the tractor A-frame.

After trying several methods for coating removal, including burning, a scraping procedure was adopted which had been suggested by a Journal article. This operation utilized a scuffing sleeve fabricated on the job. The sleeve was made of a piece of 8-in. pipe, indented at the ends, and then bent down to give an orange-peel effect, so that the edges of the bent pipe would scrape along on the 6⅝-in.-o.d. pipe to knife off or scuff off the old coating originally applied with glass reinforcing and asbestos felt.

The scuffing sleeve was pulled along over the pipe by a winch line operated on either a power wagon or a truck. In this scuffing or peeling operation, the pipe had to be kept as cool as possible. Therefore the scuffing rigs operated in the shade.

After coating was scraped off, the pipe was run twice through stationary cleaning machines — by one pass through each of two units. These two cleaning machines were placed one behind the other for continuous sequence operation.

The yard equipment for scraping and cleaning was moved from point to point as the work progressed and set up at locations at intervals of 12 to 15 miles.

All coating was applied over the ditch by traveling-type equipment. The 11 miles of pipe buried close to the railroad has been protected by coal-tar enamel, glass mat, and asbestos felt.

The pipe laid on top of the ground away from the railroad route—in sections totaling about 100 miles — was coated by Williams Brothers with oil-base aluminum paint. This was applied by a traveling-type priming machine. The aluminum paint protected the pipe against oxidation and decreased absorption of heat from the sun. Such application is familiar in the United States for aboveground tank-farm and stream-crossing lines.

Work of relaying started from the hot Magdalena River Valley at Puerto Berrio after operations for cutting up and removing coating from the old line had moved well up ahead.

Since the spread equipment had to be moved ahead entirely on the railroad, there were frequent interruptions of 1 to 3 hours for removing the pipeline work train to sidings located at 12-mile intervals in order to permit the railroad's own trains to pass. Although the gangs were on the job 10 hours a day, actual working time averaged only about 6 hours. There were no access roads, so there was no alternative to depending on the railroad for moving forward.

The rainy seasons in early summer and late fall sometimes stopped work entirely for a week at a time.

All overland ditch was dug by hand. Back hoes dug stream crossings.

The project was handled by three gangs—the laying gang, which handled ditching and welding; the coating and wrapping gang which handled lowering in and backfilling, and the aluminum-paint gang which followed some distance behind for both aluminum painting and the welding at tie-ins.

Construction started in May 1954 and was ready for operation late in February 1955. Hydrostatic testing was done at 1,000 psi. in sections of 24 to 30 miles long.

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3.	8.10*	0.86
4.	7.50	0.08
5.	16.00*	1.30

** These wells receiving "anti-corrosion" treatment. Replaced by Visco.*

1 mil = .001 inch. A corrosion rate of 216 mils per year means that the corrosive attack, if uniform, would have corroded away the entire surface of the metal to a depth of .216 inches in a year. However, the real danger of high corrosion rates, as the coupon shows, is the much deeper and faster penetration occurring at localized areas.

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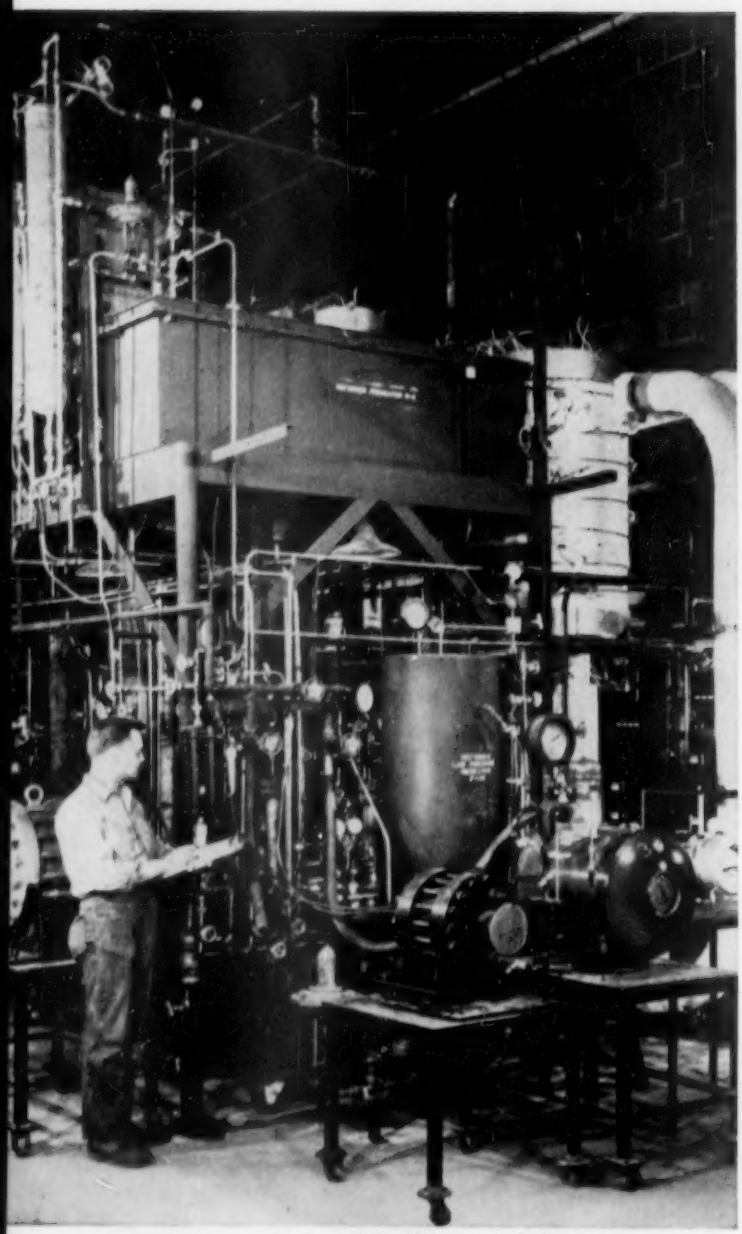
New catalytic reformates road-tested by Ethyl Research



Samples for analysis at Ethyl Research Laboratories are taken directly from the pilot plant of the reformate process developer.

In choosing one of the important new reforming processes, or in planning the over-all refinery operations once the plant is on stream, it is vital to know how the reformate will behave in the gasoline to be marketed.

That's where we can help you. Ethyl's Refinery Technology group in Detroit, working closely with the developers of these new processes, has prepared several reports on road antiknock behavior of reformates. And more reports are in process.

Each of these Ethyl reports is based on evaluation of reformate samples from commercial units or from the developer's pilot plant. We blend the new reformates with typical refinery base stocks—straight-run, catalytically cracked, and thermally cracked naphthas—to produce typical gasolines. "Ethyl" antiknock compound is then added, and the gasolines are road-tested on chassis dynamometers in our controlled-weather rooms.

Finally, all the information is collected, evaluated and submitted for approval to the developer of the process.

Reporting to the industry on the behavior of catalytic reformates is another example of how Ethyl is helping serve your needs.

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Research Laboratories

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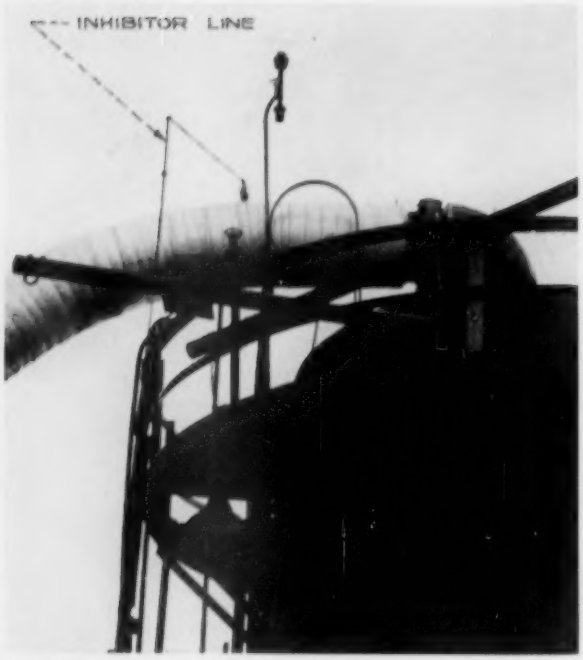
Final report on a new reformate process is presented to customer by Ethyl Fuel Technologist Alon Cole. This and other Ethyl Research reports are available to you through the Ethyl Refinery Technologist in your area.

Reformates are blended with various runs of gasoline and tested by Ethyl technicians.

Road testing is performed with various gasoline stocks in Ethyl's highly instrumented controlled-weather rooms.



CORROSION INHIBITORS are being used more and more in curbing corrosion in refining equipment. As shown here, one operator adds inhibitor in the vapor line at the top of a distillation tower.

HYDROGEN BLISTERING can cause rapid deterioration of refining equipment, as shown here in this view of the interior of the shell in a gas cooler. Adding oxygen will halt hydrogen blistering.

Here's what they're doing to

STOP THAT COSTLY CORROSION

. . . in refining equipment

as reported by

by Gerald L. Farrar
Engineering Editor

This report to Journal readers is a resume compiled from technical papers, informal discussions, and symposiums presented at the recent annual meeting of the National Association of Corrosion Engineers in Chicago.

Technical papers from which some of the information is drawn are: "Air Injection Prevents Hydrogen Penetration of Steel," by W. A. Bonner and H. D. Burnham, Shell Oil Co., Wood River, Illinois; and "Refiner Halts Corrosion with Organic Inhibitor," by Charles Fiske and Paul Mernitz, Leonard Refineries, Inc., Alma, Michigan.

INJECTION of air into refinery process units will halt hydrogen penetration of steel and subsequent blistering. The method has been tested for 2 years in Shell Oil Co.'s Wood River refinery. None of the units which have been thoroughly inspected has shown attack since air injection was started.

Oxygen from the air reacts with the hydrosulfide ion to produce elemental sulfur. This in turn forms a complex with a sulfide ion to produce the polysulfide ion. The polysulfide forms an impervious coating on the steel vessel walls. Atomic hydrogen, which is the culprit in hydrogen penetration, cannot go through this coating.

Test results were determined by using a hydrogen-penetration probe. This device is a short, thin-walled steel pipe with valve and gage. It is placed in the vessel to be tested. If hydrogen penetration occurs, pressure as measured by the gage increases.

The probes have been used for 4 years to supply records of conditions existing in the various refinery units. Many of the original probes are still in use.

Other methods tried . . . Coatings tried in one refinery failed to prevent penetration. A replacement vessel of A.S.T.M. A-201 "B" steel blistered lightly in 1 year.

Expendable steel liners successfully protect steel vessels, but they cost too much to install and replace. Cement-type linings are readily applied and furnish good protection for large equipment. But they can't be used for pipes and condensers.

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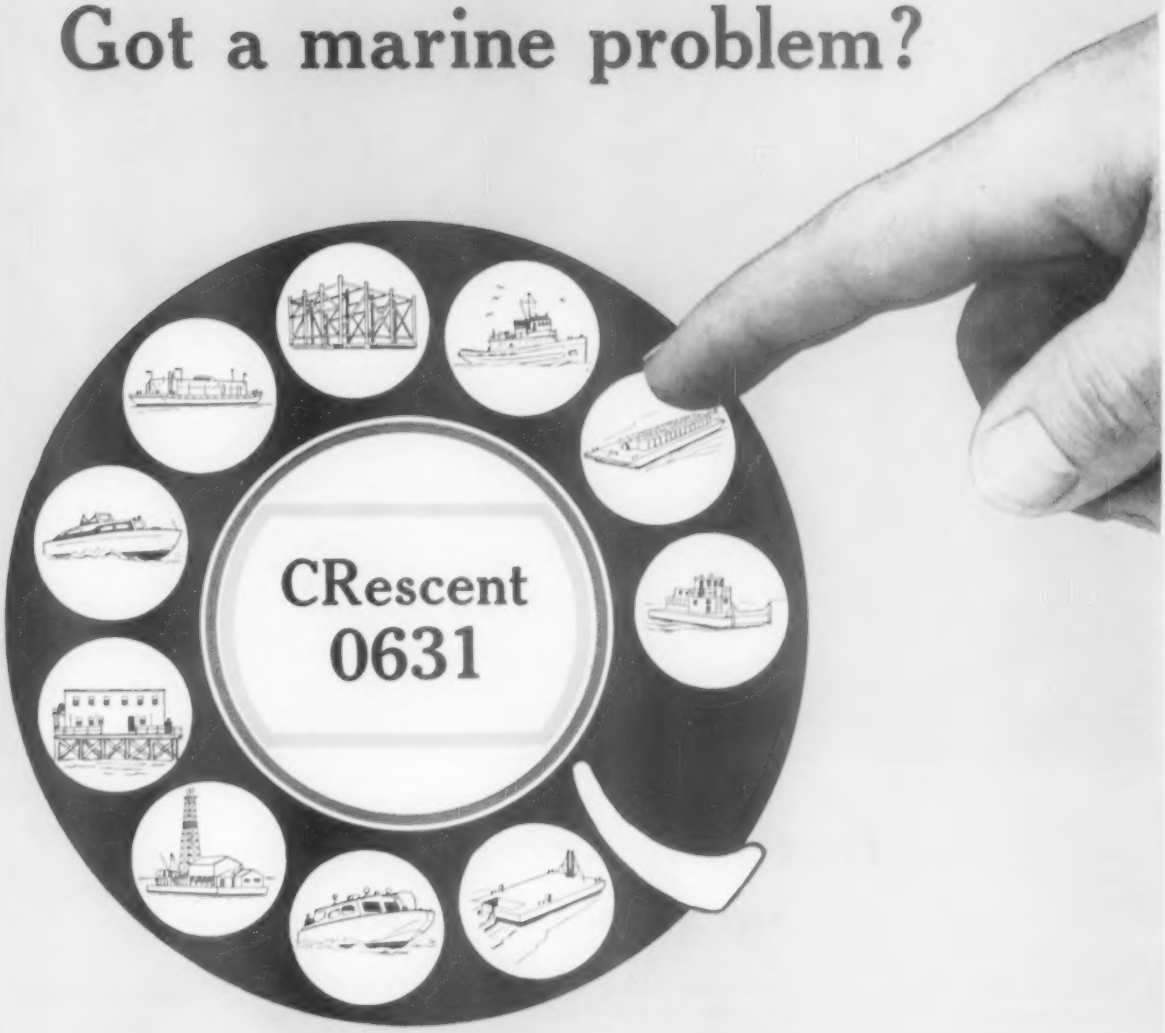

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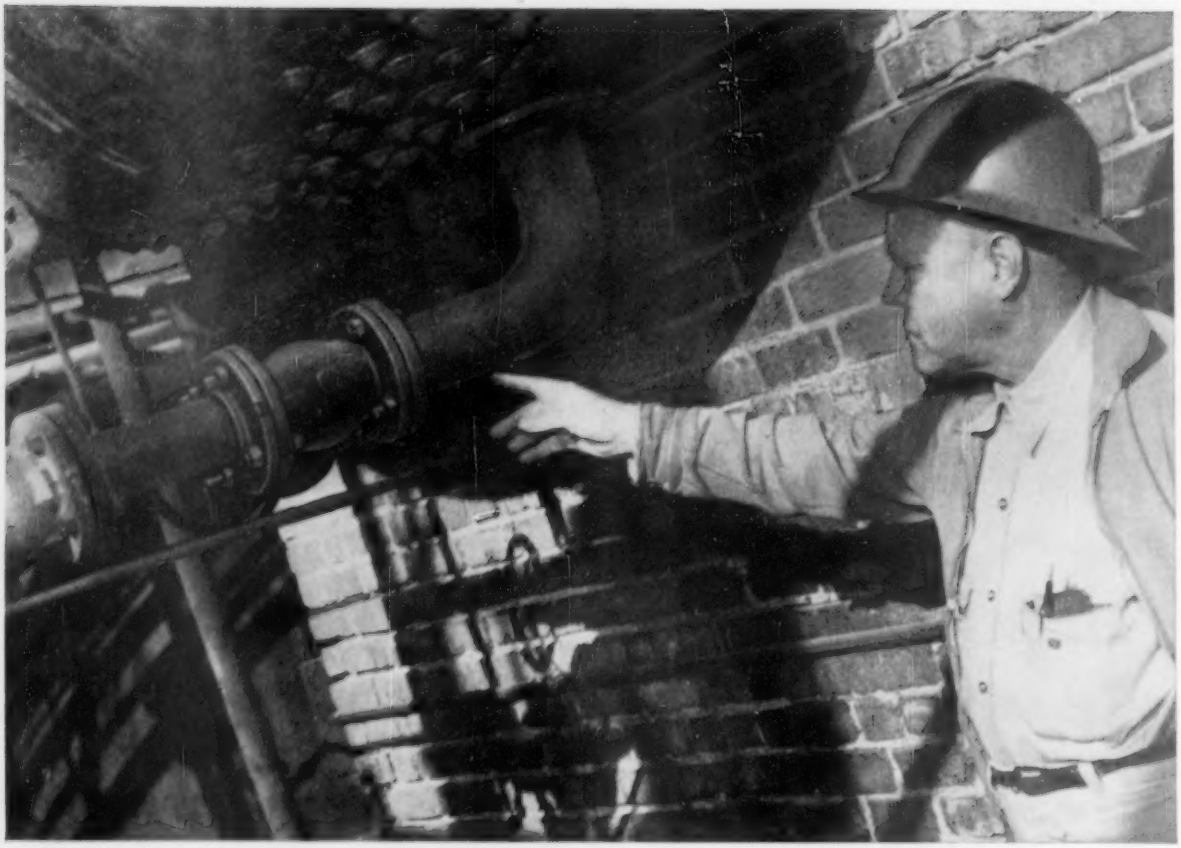

That's the long-life valve on sulphuric acid

THE CASE HISTORY: At a large midwestern refinery there were recently two valves of different makes on a 90% sulphuric acid line. As seen in the photo above, these valves worked under identical conditions, almost side by side—each operated about three times daily.

Less than a year in the line, the valve at left started leaking, with the leak getting rapidly worse. In contrast, the Crane No. 475½ all-iron gate valve at right, with two years' continuous service to its credit, was still giving completely good performance.

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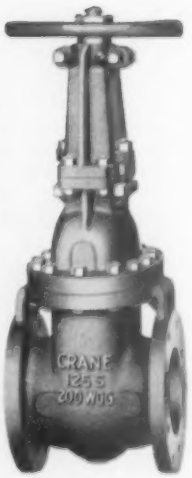

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ganic compounds with inhibiting properties also failed to halt the penetration.

Corrosion reactions . . . The primary corrosion reaction under refinery conditions which occurs on steel in an aqueous layer saturated with hydrogen sulfide is thought to be Equation 1.

$$Fe + H_2S\,(aq) = FeS + 2H^{\circ} \quad (1)$$

When iron corrodes in the absence of sulfide, the combination reaction is fast and molecular hydrogen escapes from the steel surface.

In the presence of sulfide, the combination reaction is slow and the concentration of atomic hydrogen builds up on the surface. As a result of the high surface concentration, atomic hydrogen penetrates the steel in which it is slightly soluble. The atomic hydrogen diffuses through the steel, collects at discontinuities or defects, and combines to form molecular hydrogen.

In alkaline systems under anaerobic conditions, the corrosion reaction, Equation 1, continues indefinitely with the ultimate formation of blisters and fissures in the steel.

This reaction can be stopped by the addition of polysulfide or materials such as oxygen, free sulfur, or ferric ion, which lead to the formation of polysulfide in alkaline aqueous solutions. However, free cyanide converts polysulfide to thiocyanate, according to Equation 2.

$$CN^{-1} + S_2^{-2} = SCN^{-1} + S^{-2} \quad (2)$$

Excess free cyanide promotes corrosion and hydrogen penetration with the formation of ferrocyanide, Equation 3.

$$Fe + 2H^{+1} + 6CN^{-1}(\text{presence of } S^{-2}) = Fe(CN)_6^{-4} + 2H^{\circ} \quad (3)$$

Why oxygen helps . . . Oxygen in the gas stream reacts with the hydrosulfide ion according to Equation 4 to produce elemental sulfur which, in turn, will complex with a sulfide ion to produce the polysulfide ion, Equation 5.

$$2HS^{-1} + O_2 = 2OH^{-1} + 2S^{\circ} \quad (4)$$

$$S^{-2} + S^{\circ} = S_2^{-2} \quad (5)$$

It is desirable to have an excess of air in the system to protect against unusual conditions which may increase cyanide production. Actually, due to the short resident times at each stage in the system, equilibrium conditions are never attained. Thus, even with sufficient air theoretically to remove all cyanide, free cyanide may remain in the gas streams.

It is possible, however, to stop hydrogen penetration by having sufficient air in the gas to form polysulfide on the steel at a slightly higher rate than it is removed by cyanide.

However, excess oxygen can lead to hydrogen penetration. This condition was detected by activity of probes located in the vapor area of the depropanizer accumulator during a trial period of **high** air injection—more than 10 times the theoretical.

About a day after the start of air injection, probe activity had almost stopped. However, after about 4 days, probe activity increased. Air injection was then discontinued, and probe activity diminished slowly.

During the early plant trials of air injection, the removal of ammonium thiocyanate from the processing equipment received little attention. After several weeks' operation, corrosion products, ferrous sulfide, and iron thiocyanate appeared on suction screens and obstructed the hydrocarbon flow from the bottom of an absorption column. The water accumulation was very small and the pH ranged around 5.0. On cooling a sample of accumulated water from a column, a crystalline material was formed which was removed and identified as ammonium thiocyanate by X-ray diffraction.

About the same time, a reciprocating compressor, which was processing gas to which air had been added, was found to have severely corroded low-carbon-steel valve seats. Deposits on the valve seats were found to be ferrous sulfide and iron thiocyanate.

Tests showed that ammonia thiocyanate can cause high corrosion rates in the presence of air or polysulfide at elevated temperatures in both acid and alkaline solutions. However, if the concentration of ammonium thiocyanate is kept below approximately 10 per cent, and the pH is maintained above 7.8, corrosion rate is very low, even at a temperature of 190° F. Fortunately, ammonium thiocyanate is very soluble and can be removed from processing equipment by washing with small amounts of water.

Facilities were installed to wash with 3 to 5 gal. of water per minute at the absorption column. Subsequent inspections have shown no further corrosion since water wash for the removal of ammonium thiocyanate began.

To minimize both hydrogen penetration and hazards of solid salts depositing with the existing gas composition, operation in the pH range of 7.8 to 8.3 is required.

No recurrences of ammonium bicarbonate deposition have occurred in the plant since this upper pH limit was specified.

Summary of Refinery Experience

There are four small air compressors, each with adjustable delivery rate, in the Wood River refinery which have been in operation from 1 to 2 years. At the time the first compressors were started, probes were observed daily to follow hydrogen penetration rates. As the activities decreased, fewer readings were considered necessary. Currently, probes are read three times a week. In addition, spot tests for ferrocyanide and cyanide ions and pH of water samples are obtained on a weekly basis.

In every case where the pH has been above 7.8 and the proper amount of air has been injected into the gas stream, the probe activity dropped to practically zero and ferrocyanide or free cyanide was no longer detectable in water accumulations.

Two air compressors are in service at the catalytically cracked gas system. Air is injected into the suction of the first compression stages to insure adequate residence time in the system. These units have been in operation for about 2 years. The combined amount of air delivered by these compressors is 0.2 s.c.f. per minute per M.M.c.f. per day gas. Based on the average cyanide make, this represents approximately twice the amount of oxygen required to convert cyanide to thiocyanate.

Thermal system . . . Although blistering in the thermally cracked gas system has not been as severe as in the catalytically cracked gas system, a progressive formation of blisters has been observed in condensers and accumulators. Air injection for the control of hydrogen penetration has, therefore, been required. Air compressors have been installed on two separate streams. The combined air injection rate of the two compressors, which have been operating about 1 year, is about 0.15 s.c.f. per minute per M.M.s.c.f. per day gas. This air rate is approximately six times the stoichiometric requirement but no difficulties have developed due to this excess air since there are no stagnant vapor areas in the system. Operation has been good.

Variations in cyanide and gas production, as well as system upsets, will occur. These will lead to variable oxygen requirements, and possibly occasional sporadic probe activity with accompanying occurrence of ferrocyanide. Experience has indicated that minor probe activity (say less than 0.1 cc. per sq. in. per week) maintained for only 2 or 3 weeks on a standard probe, or even high sporadic rates maintained over short periods, are of little consequence in promoting hydrogen damage.

Further, following a change in air injection rate, several days may be required to reestablish equilibrium. Thus, no attempt is made to adjust the oxygen rate on a day-to-day basis.

Organic Inhibitor Gets Results

USE of an organic corrosion inhibitor at the Alma, Mich., refinery of Leonard Refineries, Inc., has shown these results:

- It has extended the useful life of the crude tower several years.
- Inside surfaces of the various vessels are cleaner. This has lead to (1) better fractionation, (2) better heat exchange in coolers, (3) far less severe plugging, and (4) less down time.
- Corrosion control is being maintained with fewer operating upsets. There is no evidence of hydrogen blistering.
- Quality of product streams has improved, due to cleaner and better operation.

Three years' experience . . . The Alma refinery started processing high-sulfur crudes in January 1952. A relatively small percentage of the charge was sour Wyoming crude, the rest being sweet Texas and Michigan stock.

When the tower was opened for inspection in September 1952, many of the bubble caps in the distillate and gas-oil sections were completely plugged and large quantities of iron oxide and iron sulfide scale were taken from the tower.

Two trays in the distillate section was completely gone. Four others needed replacing. Much of the internal metal could be folded up like kraft paper and the bubble caps could be picked off the trays, their chimney T-bolts having corroded through.

Ammonia addition has been sufficient to maintain the pH of the naphtha receiver water well above seven, averaging near eight. Thus corrosion protection offered by pH control method was inadequate, and decision was made to try an organic corrosion inhibitor.

The main consideration was protection of the bottom section of the crude unit. On November 29, 1952, injection of the corrosion inhibitor was begun at a point on the same level as the crude inlet to the tower, 90° around from the crude inlet nozzle. The temperature at this zone is about 560° F.

Inhibitor use was set at 20 p.p.m. based on the crude input. Charge rate was about 6,900 bbl. per day of crude, and about 40 lb. per day of inhibitor was required.

The inhibitor used is Nalco 161, a film-forming amine made by National Aluminate Corp. It is a proprietary compound which is soluble in aromatics and dispersible in aliphatics when continuous mild agitation is provided. Because of a convenient source of kerosine, a 15 per cent dispersion of inhibitor in this product was made up in a blend tank on a daily basis and kept in suspension by means of a small continuous air spray.

To test the effectiveness of the inhibitor, a daily test of the iron content of the naphtha receiver waters was set up. During the ammonia-injection period iron content ran 300 p.p.m. on some occasions and very frequently in the 100-150-p.p.m. range. Also, corrosion coupons were placed in the tower on the tray about at the distillate draw-off tray and in the top of the tower.

After receiver water iron content indicated that satisfactory protection was being obtained, the ammonia-addition rate was gradually decreased, thereby reducing the pH of the receiver water. Data from a 7-month test period show that good protection results of pH's above 6.5. Control limits for pH were then set from 6.5 to 7.5 to be controlled by ammonia addition. Savings resulting from reduced ammonia requirements just about pay for the inhibitor.

A short shutdown in January 1953 was the first opportunity to examine corrosion coupons placed 2 months before. While the metal loss was not great, (first entry—Table 1) a relatively small proportion of very corrosive crude had been processed. This, with the fact that receiver water samples showed erratic iron content, led to the idea that injection higher in the tower might stabilize the protection. Provision was made to inject the inhibitor on the distillate draw tray, No. 14, approximately two-thirds of the tower height. Tests showed it should be added below the liquid level on the tray.

When the crude unit was next shut down for inspection in August 1953, visual inspection showed the tower to be in very good condition. A film of corrosion inhibitor was found on the metal all through the lower section of the tower, almost no scale or dirt was found on the trays and it appeared that the slots in the bubble caps had cleaned up slightly.

Corrosion coupons from the top of the tower (third entry—Table 1) indicated that the tower still didn't have adequate corrosion protection for the overhead vapor space. The corrosion coupons at the distillate draw level had lost no metal, and appeared to have an oily protective film. The tower generally had been protected in the same way at lower levels.

There was a great increase of metal loss from the top coupons in this period of change from a low to a high proportion of sour crude (second and third entries, Table 1). Consequently, it was then decided to add a second stream of inhibitor into the naphtha reflux to the top of the tower.

The inhibitor addition was set at 6 p.p.m., based on the overhead product plus the reflux back to the tower. Visual inspection plus our corrosion coupons (sixth entry—Table 1) indicated good protection with this dosage. Coupon penetrations show 1-2 mils per year penetration of mild steel at the top and about 1½ mils per year at the distillate draw level.

Unscheduled shutdowns on the crude unit have been reduced from 178 hours in 1950 to 51 hours in 1954.

Other Applications

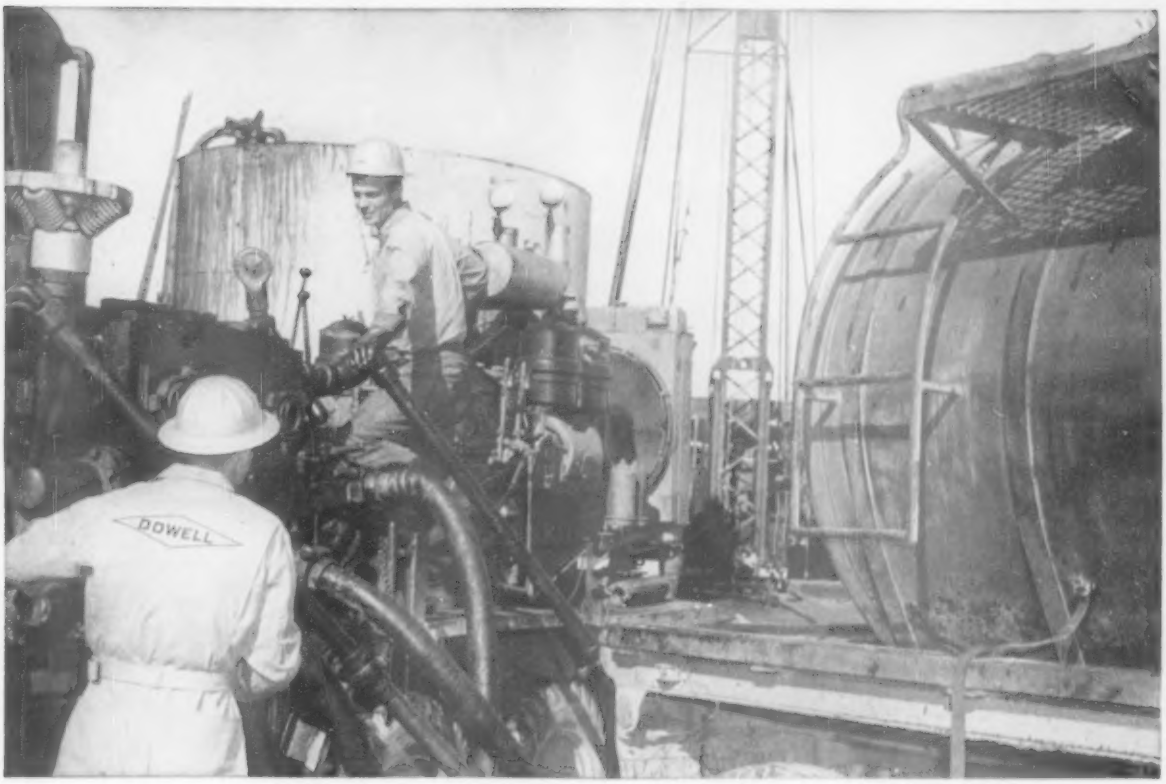
Later, additional streams of corrosion inhibitor were injected into other vessels whenever inspection indicated a corrosion problem. For example, there was pitting on the hydrocarbon side of the admiralty tubes in the overhead exchangers for cat cracked gasoline.

An inhibitor dosage of about 8 p.p.m. based on overhead and reflux in the overhead vapor line of the synthetic crude tower led to the reduction of the copper picked up by the cat cracked gasoline from 0.1 mg. per liter to the lower limit of test, about 0.01 mg. per liter. Visual inspection also shows adequate protection.

TABLE 1—CRUDE UNIT PROTECTION USING ORGANIC INHIBITOR

	IPY penetration X1,000, coupons					
	Top		Top tray		Dist. draw	
Condition—	405SS	MS*	405SS	MS	405SS	MS
No inhibitor, semisour crude, 2-month period	1.52					
20 p.p.m. inhibitor, semisour crude, 2-month period, near crude inlet	0.42	0.42			0.40	1.19
20 p.p.m. inhibitor, sour crude near distillate draw, 5-month period	3.25	38.91			Nil	Nil
20 p.p.m. inhibitor, sour crude near distillate draw and overhead, 8-month period	Nil	Nil			Nil	Nil
No inhibitor, high pH control sour crude, 5-month period	0.56	1.73	0.30	4.05	0.005	2.29
6 p.p.m. inhibitor, sour crude overhead, 6-month period	0.11	0.53			Nil	1.57

*Mild carbon steel, A.S.T.M. A-285 Grade C, flange quality.



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CORING is an excellent method for evaluating a potential oil zone. The engineer or geologist examines the core at the well and then sends it to the lab for detailed analysis.

How to Size Up Wildcat Pay Zones

Formation evaluation is not a static thing. Some of the old methods are fallacy-ridden and should be replaced by modern interpretive techniques

by J. E. Walstrom and J. C. Wells

FORMATION evaluation as applied to exploratory drilling is a complex and versatile problem. Many factors, both known and unknown, must be considered in working up a program, and the methods or techniques employed must be both complete and economical.

With the tools now available, and proper training in their use, complete evaluation can usually be achieved if these tools are used liberally and in a complementary manner. Future improvements are expected to include more economical tools and a better integration of services by the logging companies.

Planning of exploratory well programs is therefore one of the most important assignments that may be given to a petroleum geologist or engineer. The following discussion will be devoted to the factors which must be considered in designing such a program and a brief listing of the use and limitations of the many tools and techniques which are available to us.

The items which should then be considered and provided for in the evaluation program for exploratory tests are:

1. The number, depth, thickness, and vertical distribution of the possible objective zones.

2. The physical nature of the objective zones, such as lithology, permeability, amount and type of porosity, type of hydrocarbons, and formation pressures.

3. The chemical nature of the formations to be penetrated, such as salt and gypsum, which will determine the type of drilling fluid to be used, and sulfur and toxic gases which may influence the testing and completion programs.

4. Reliability of log correlation with nearby wells.

5. Complexity of structure. Steep dips, faulting, etc., not only affect the types and number of logs, but may also affect drilling and coring methods. Hole deviation is commonly a serious problem in steeply dipping strata and lost circulation is frequently associated with faulting.

6. Physical factors affecting the drilling program. Lost-circulation possibilities, high head waters, caving shale, dry-gas zones, and estimated drilling rates in the various formations must be carefully considered. To ignore any of these factors is to invite disaster, and it is far better to be overcautious at the outset.

The authors are with Standard Oil Co. of California, San Francisco. Paper presented at spring meeting of Pacific Coast District, A.P.I. Division of Production, Los Angeles, under the original title, "Formation Evaluation in Exploratory Drilling."

Evaluation during penetration . . . Twenty years ago visual examination and smelling of cores, cuttings, and mud returns were the only means of finding oil or gas while drilling. Today, although the well-site geologist is still a "mud smeller," his olfactory equipment is supplemented by more sensitive tools. With the advent of mud logging in 1938, a new "package" service was developed which now relieves the geologist of much of the tedious watching and sampling and provides the operator a more continuous, more accurate, and more detailed record during penetration.

The principal advantages of mud logging which have caused this service to be so widely used in exploration drilling are:

1. It is a direct method of detecting the presence of oil and gas and provides 24-hour insurance against passing up possible production.

2. The results are available in time to control the drilling, coring, and testing program.

3. No rig time is consumed except

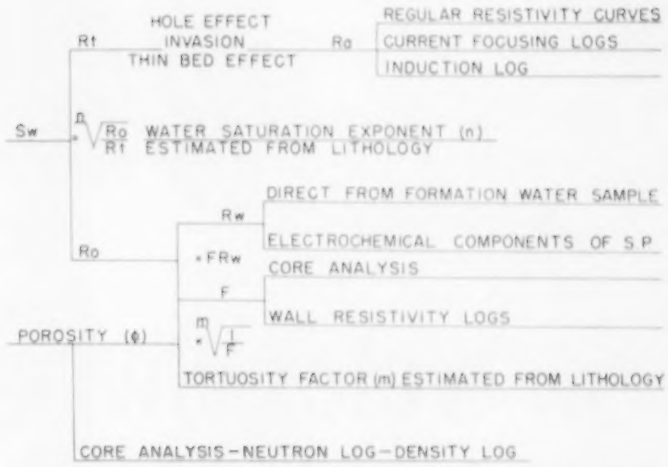
for that lost while circulating out shows or drilling breaks.

The usually slower and more expensive method of evaluation during penetration, that of coring and core analysis, has been greatly reduced, and in some areas almost eliminated, by mud logging, sidewall sampling, and quantitative calculations from electric logs. However, in some hard-rock areas where diamond coring is as fast as drilling and sidewall sampling yields poor results, coring is still of primary importance. Coring is usually required also to determine the character of the formation from which mud-logging shows are obtained prior to running electric logs or testing.

Core analysis is a subject which can better be covered under reservoir engineering. Properly interpreted, it is a valuable tool, but should not be relied upon when the results obtained do not agree with reservoir saturations calculated from electric logs under proper conditions.

Another qualitative method of lithology determination while drilling, which has been tried experimentally since about 1935, is continuous electric logging at the bit. Good contrast has been obtained at formational boundaries with these curves. The method should be of considerable value in exploratory drilling if a suitable method can be worked out for transmitting electric current up and down the drill pipe which will eliminate the cumbersome and unreliable method of threading cable through the pipe.

Evaluation after penetration . . . Exploratory-well programs in many areas now contain instructions such as: "If a show is obtained by the mud-logging unit, circulate out, and if show persists, take a core. If possible reservoir conditions are indicated by core recovery, run electric log, and if warranted, make a formation test." This brings us to the second major classification, that of evaluation after penetration. The cheapest and most universally available tool for that purpose is the electric log. Very few exploratory wells are drilled today, even in the most remote areas, without at least one electric-log run being made. Fig. 1 shows a graphic picture of the two properties of potential reservoirs which we try to arrive at from the best possible utilization of logs and other complementary data. The answers obtained are seldom exact in the mathematical sense, and in exploratory drilling, such accuracy should not be expected. If we can determine which zones are worthy of further evaluation by testing or running casing if necessary, the electric log has served its purpose.



THE ELECTRIC LOG serves as a guide in formation evaluation and can be used to determine which zones to test. Fig. 1.

Another type of auxiliary electric log, which in some areas is replacing the conventional resistivity curves for obtaining resistivity in thin beds, is the current-focusing log. This type of log, known by the trade names of Laterolog and Guard Electrode, employs the principle of the segmented cylindrical electrode.[4] Current-focusing logs, like the Laterolog and Guard Electrode, are used most extensively in areas where salty muds are used.

A type of log which is similar in appearance to a current-focusing log in that the measurement is primarily radial, is the induction log.[5] The induction log is an ideal system where nonconductive drilling fluids such as oil-base are used.

FROM CORE DATA engineers can often determine the productive possibilities of a particular reservoir. Fig. 2.

Radioactive logging . . . Another relatively new and fast-expanding field in well logging as applied to exploratory drilling is that of radioactivity logging. The first radioactivity logs were introduced in 1940, but during the first few years they were used primarily to log old wells in proved fields drilled prior to the advent of electric logs. Today, with better shielding and more efficient types of recorders, gamma and neutron logs have replaced electric logs for lithology and porosity determinations in some areas, and new types of logs, still in the development stage, may be even more useful in exploratory drilling.

The measurement of the degree of natural radioactivity with the gamma-ray log is in some areas, notably Kansas and West Texas, the best way of distinguishing lithology after penetration. The radioactivity contrast between major lithologic types is usually distinct and characteristic and the gamma-ray log has the appearance of an S.P. log in other areas. It is, therefore, common practice to use the gamma-ray log as a substitute for the S.P. log in those areas where natural potential contrasts in the borehole are low because of salty mud or dense, highly resistive formations. A new service now being offered by one of the logging companies measures the relative concentrations of high and low-energy gamma rays as well as the total gamma response. This may provide a means of recognizing different shales as well as distinguishing some of the more radioactive sands from shale by the different concentrations of the various radioactive minerals which give off gam-

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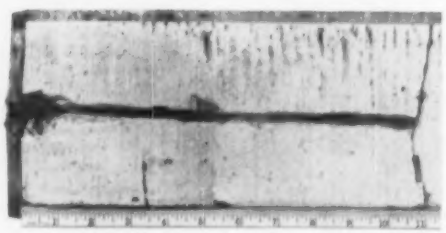

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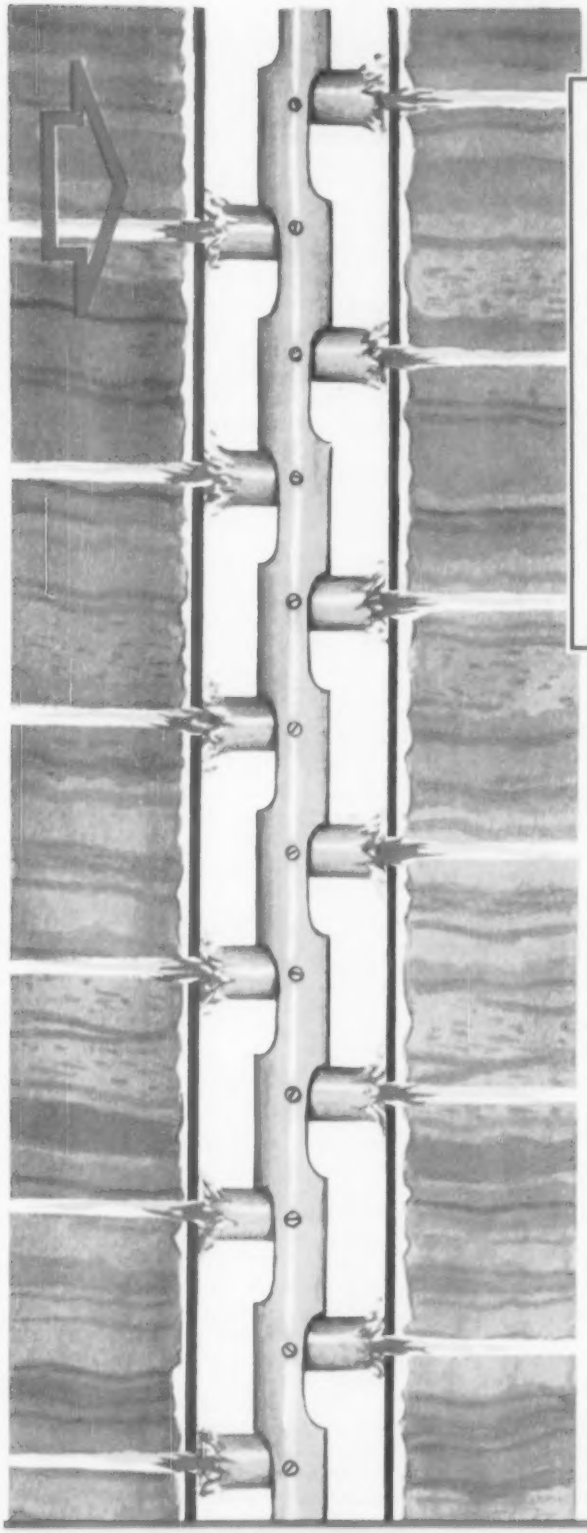

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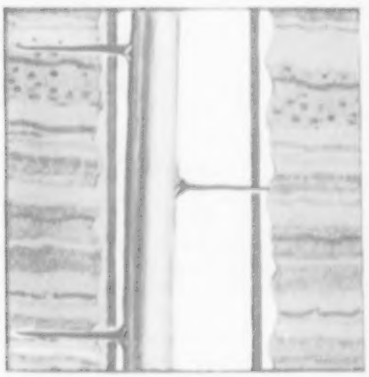

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ma rays at widely different energy levels.

The neutron log is, at the present time, the only widely used type of induced-radioactivity log; it is used in exploratory drilling primarily as a qualitative indication of porosity, and also to some extent as an indicator of dry gas, particularly in areas where electric logs are not diagnostic because of fresh formation water. Because hydrogen is the most effective element in slowing down neutrons, the presence or absence of fluid is indicated by low or high neutron response, respectively. A dry-gas sand may be distinguished from a dense rock by comparison with a MicroLog if the lithology is not known.

Two other types of induced-radioactivity logs, which are still in the development stage but have been run experimentally to a limited extent, are the density log and the nuclear spectroscopy log.

Sidewall coring . . . A method of formation evaluation after penetration which is auxiliary to the electric log, but not as such, is sidewall sampling. Because of the speed and selectivity of sidewall sampling, this method has largely replaced coring in some areas for checking lithology and oil shows and also to some extent for obtaining faunal data and establishing gas-oil interfaces.

Drill-Stem Testing

With packers and tool assemblies now available, successful open-hole tests are made in most areas to depths 15,000 ft. In hard-rock areas, these tests can be made anywhere in the borehole with the new straddle packer and selective zone testers. In soft-rock areas, however, the use of a lower packer below the test interval is usually considered hazardous because of possible caving. The usual practice in these areas, except in the Miocene of the Gulf Coast where any open-hole testing is hazardous, is to rest the tail-pipe assembly on the bottom of the hole or on a cement plug and set the packers above the test interval. The discussion to follow on accepted practices in various areas will cover this subject in more detail.

California Tertiary . . . Although many complex and diversified problems are encountered in California, it is possible to make some generalizations which might be summarized as follows:

1. Formation waters encountered in possible productive horizons range from fresh (±50 grains per gallon) to moderately salty (2,500 grains per gallon), but most commonly fall in the range of 500-1,500 grains per gallon.

2. Productive sands are unconsolidated to partially cemented and commonly show poor sorting. Grain size may vary from silt to boulder conglomerates and clay is present to some degree in nearly all California sands.

3. Fractured-rock production is limited to cherty shales and basement rocks (usually schist).

4. Carbonate rocks are absent in the Tertiary except for a few thin limestone beds which have no effect on the evaluation program.

5. Heavy mud is required in many areas to combat high-pressure water and gas zones.

6. Regional correlation is difficult because of rapid facies changes and complex structures.

Generally accepted evaluation practices are as follows:

1. Mud-logging units are now used on most exploratory wells and coring and testing programs are usually dependent upon shows obtained.

2. Coring is usually held to the minimum required for evaluating shows, checking lithology, and obtaining dip and faunal information. In some deep tests, however, particularly in Eocene rocks, where oil-base mud is used to combat bad hole conditions, continuous diamond coring has proved to be almost as economical as drilling.

3. The conventional electric log is run in all wells and the MicroLog in nearly all exploratory wells. Current-focusing logs are rarely used because the resistivity contrast between the drilling fluid and formation water is usually too high. The use of the induction log is presently restricted almost entirely to holes where oil-base mud is used. Because of poor radioactivity contrast, radioactivity logs are rarely used in exploratory drilling except for accurate depth measurement when perforating for completion and to check for dry gas.

4. Quantitative calculations for water saturation utilizing the electric log and MicroLog can usually be made with sufficient accuracy to guide the testing program except where extreme thin-bed conditions are encountered. The clayey sand nomograms developed by Schlumberger are very helpful where formation waters are sufficiently salty to give a good S.P. curve.[2]

5. Preferred practice with most operators is to test on the way down and hole conditions are usually such that open-hole formation tests can be made safely. Sidewall packer tests with the tail pipe resting on bottom are the usual procedure, and deep tests are usually made in reduced hole. Straddle-packer tests and selective-zone tests have met with some success, but are often hazardous because of caving formation within the test interval sticking the bottom packer.

Gulf Coast Tertiary . . . Evaluation problems, though serious in this region, are not as diversified as in the California Tertiary. Consequently, the accepted practices are more standardized. Conditions affecting the program might be summarized as follows:

1. Formation waters in possible productive horizons are very salty.

2. Productive sands are unconsolidated and usually well sorted. Clayey sands are common but massive boulder conglomerates are absent. Both sands and shales cave and slough badly.

3. There is no fractured-rock production and carbonates are absent.

4. Heavy mud is required to combat high pressures in deep wells.

5. Prominent sands are more continuous than in California and can be correlated over large areas.

Generally accepted evaluation practices are as follows:

1. Mud-logging units are now used on all exploratory wells from surface pipe to total depth and on many wells from conductor pipe to total depth.

2. Coring has been largely replaced by sidewall sampling for evaluating shows. Percussion-type samples can be obtained quickly at any point in the borehole and conditions are ideal for good recovery.

3. The conventional electric log and MicroLog are run in all exploratory holes. Current-focusing logs are sometimes used where prospective sands are thin and where lignites and mineralized zones affect resistivity interpretations.

4. Mud resistivities are usually less than 0.5 ohm-meters at the surface and lime treatment is commonly used to reduce water loss. The S.P. curve is not seriously affected by the lime mud because of the very salty formation waters.

5. Quantitative calculations for water saturation utilizing the electric log and MicroLog can usually be made with sufficient accuracy to guide the testing program. Clayey-sand techniques work very well because of the very salty formation waters and relatively low mud resistivities.

6. Open-hole formation tests are seldom run, especially in deep holes, because of the soft formations which tend to cave and slough. Testing is normally done on the way out by running casing and selectively perforating the best-looking intervals on the basis of mud-logging shows, sidewall samples, and electric-log interpretation.

Rocky Mountains . . . This is a hard-rock country. Production is obtained from both intergranular and fracture

porosity in sandstones and carbonates and from fractured shale. Formation waters range from very fresh (20 grains per gallon) to moderately salty (1,800 grains per gallon). Salt beds present no serious problem (see section on Williston basin below) but gypsum is abundant in many of the formations penetrated and gyp-base muds are used to prevent hydration and caving. Regional correlation of formational units is good and many individual beds can be traced over large areas. Although evaluation practices vary somewhat with different operators, the general procedure is as follows:

1. Mud-logging units with core-analysis equipment are now used on nearly all exploratory wells from surface pipe to total depth. Oil shows in cuttings are usually very diagnostic and are closely watched.

2. Coring is used extensively. Normal procedure is to diamond core and core analyze the major objective intervals in sandstones and check all mud-logging shows and lost-circulation intervals with cores. Diamond coring in hard sandstone and carbonates is as economical as drilling in some areas. Sidewall sampling is ineffective except in shallow horizons.

3. Although the conventional electric log is run in all exploratory wells, it is often not very diagnostic because of extreme resistivity contrast, thin beds, and deep invasion. The S.P. curve is usually dampened and rounded out because of the high resistivities, particularly in carbonate sections. Wall resistivity logs lose much of their quantitative value for determining porosity when the mud cake is thick but even under these conditions they can still be used very effectively for qualitatively defining permeable intervals and are usually run through all possible objectives. The Microlaterolog, which is a focused wall-resistivity log, has been used effectively for obtaining porosity in some cases where mud cakes were less than ¼ in. in thickness.[7] Current-focusing logs are used to some extent in thinly bedded sections and could be used very effectively if less resistive muds were adopted.

4. Gamma and neutron logs are run in nearly all exploratory wells. Natural radioactivity contrast is good, thus making the gamma log very effective for correlation purposes and the neutron log is useful for locating porous intervals in carbonates.

5. The open-hole formation test is generally considered to be the best evaluation method in the Rocky Mountain region and is used freely. Hole conditions are normally good in hard rocks; thus, the hazards of packer failures and stuck tools are largely eliminated. Tests are usually made with sidewall packers above the test interval and tail pipe resting on bottom, but straddle packer and selective zone testers are also used with a high degree of success. Most operators prefer to test on the way down, and tests of several hours' duration are common practice because of slow fluid entry and deep invasion.

West Texas . . . The problems here are somewhat similar to those in the Rocky Mountains in that production is obtained from both intergranular and fracture porosity in sandstone and carbonates, but a great deal of production is also obtained from vugular carbonate reefs. The formation waters are generally saltier than in the Rocky Mountain region and thick salt beds are common, thus necessitating the use of salt muds in some areas. Accepted evaluation practices are as follows:

1. Mud-logging units with core-analysis equipment are now used on all exploratory wells from surface pipe to total depth. Oil showings in cuttings are very closely watched as they may be the only clue to possible production from carbonate reefs, and returns are often poor because of lost circulation.

2. Coring is used extensively for evaluating shows and full core analysis is favored for porosity and permeability determinations.

3. The conventional electric log is not very diagnostic, particularly in the carbonate sections and where salt mud is used. The gamma-ray log is used extensively as a substitute for the S.P. curve, and current-focusing systems have been proved to be very useful for obtaining true resistivity in thin porous intervals. Both the neutron log and the Microlaterolog are used for porosity determination, and the MicroLog is used for qualitative definition of porous and permeable intervals where the porosity approximates the intergranular condition. The limestone curve is preferred by some operators over the short-spacing two-electrode for a shallow penetration curve, and is used in some areas for porosity studies.[8]

4. Open-hole formation tests are run freely to check shows in cuttings and cores and lost-circulation intervals are usually tested regardless of shows, particularly in areas where reefs may be present. Hole conditions are generally good for running all types of packer assemblies and most operators prefer to test on the way down.

Williston basin . . . This is carbonate country and production is obtained from both intergranular and fracture porosity. Formation waters are very salty, and thick salt beds in the section necessitate the use of salt muds. Generally accepted evaluation practice which has become known as the salt-mud technique is as follows:

1. Mud-logging units are used on all exploratory wells to guide coring, logging, and testing.

2. Coring is used to evaluate persistent shows, but many productive porous intervals are so thin that they may be drilled through before a core can be taken.

3. The conventional electric logs are practically worthless for evaluation because of the salt mud and thin porous intervals. A new method for obtaining water saturation in porous intervals has therefore been developed by Schlumberger and major operators which utilizes current-focusing systems. The primary relationship is

$$R_{LL}/R_{MLL} = A/S_w^2$$

where R_{LL} is the resistivity obtained from the Laterolog, R_{MLL} is the resistivity obtained from the Microlaterolog, and $A = R_w/R_{mf}$. This relationship assumes that $R_{LL} = R_t = FR_w/S_w^2$, $R_{MLL} = R_{xo} = FR_{mf}$, that R_w is known from direct measurement of water samples from nearby wells and that formation waters are fairly uniform. These assumptions have now been proved valid in a great many cases. Porosity is obtained from its relationship with formation factor and the gamma-ray curve is a good substitute for the S.P. curve for lithology determination and correlation.

4. Open-hole formation tests are used freely as in West Texas and most operators prefer to test on the way down if possible.

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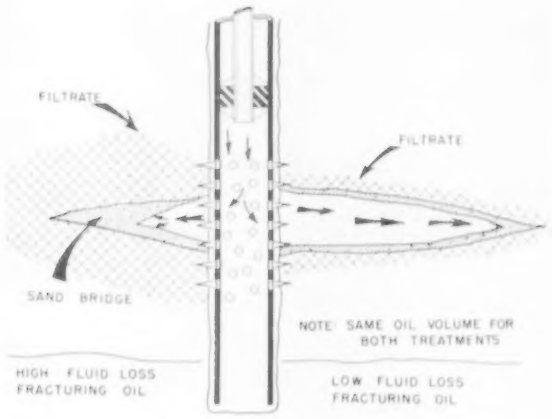

Fig. 1.

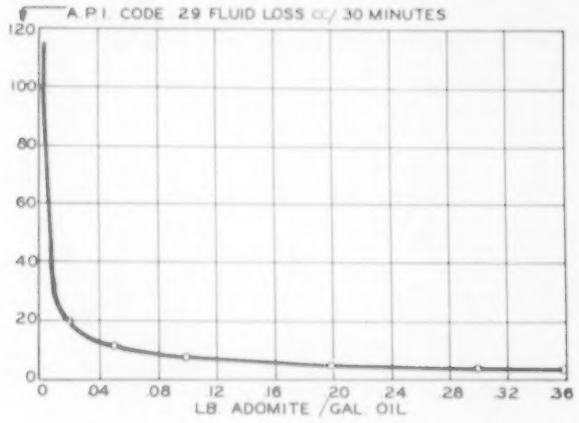

Fig. 2.

New chemical additive controls fluid loss of crude oil, making it possible to use

Lease Crude as Cheap Fracturing Fluid

by Jack J. Reynolds, Philip E. Bocquet, and Harry F. Coffer

THE production-research division of Continental Oil Co. has developed a chemical additive which will control the fluid loss of crude oil. This control makes possible the use of lease crudes as effective fracturing fluids. A fracturing fluid with a low fluid loss remains in the fracture instead of bleeding into the matrix, enabling the fracture to be extended further with a given volume of fluid. Also, lower pump rates carry the sand deeper into the fracture since the bulk of the fluid remains in the fracture to carry the sand.

All field tests of this material to date have been successful with the additive and lease crude mixed at the well site. Tests have been conducted in Oklahoma, Wyoming, Kansas, and West Texas with encouraging results.

Theory

Fracture extension . . . In considering fracture extension, it is apparent that as the fracture is extended, the contact area between matrix rock and the fracturing fluid is increased. With the use of a fracturing fluid of high fluid loss, it is obvious that as the contact area increases, the rate of loss of fluid to the matrix rock will increase and rapidly approach the pumping rate. This has necessitated the use of increasingly high pump rates with accompanying increase in cost to the operator.

Paper presented at Mid-Continent District meeting, A.P.I. Division of Production, Amarillo, Tex., under the original title, "Conversion of Crude Oils to Low-Fluid-Loss Fracturing Fluids." Authors are with Continental Oil Co., Ponca City, Okla.

It was thought that a very low-fluid-loss material would avoid this difficulty, since by confining the fluid to the fracture, a fracture volume equal to a gallon of fluid would be obtained for each gallon of fracturing oil pumped regardless of the injection rate. Fig. 1 illustrates the effect of fluid loss on fracture extension.

The remaining question was whether or not high viscosity is necessary along with low fluid loss of the fracturing fluid to prevent sandouts. Field experimental results support the theory that sandouts ordinarily begin in the fracture itself, and are not caused by the sand falling out of the liquid as it travels down the well.

If the movement of a high-fluid-loss oil through the fracture is visualized, it is evident that as the loss of the oil to the matrix increases, the concentration of the sand in the oil in the fracture also increases, and that the sand concentration will soon exceed the sand-carrying capacity of even the most viscous oils. It is believed that this mechanism provides a better explanation of sandouts than that based on viscosity.

Ideal fluid . . . Based on these principles an ideal fracturing fluid should have the following characteristics:

1. Fluid loss should be low.
2. Fracturing fluid should be made from lease crude, insuring compatability with reservoir fluids and minimizing hauling costs.
3. Viscosity should be low. Low viscosity will reduce the friction drop in tubing and reduce pump requirements.
4. The fracturing fluid should have no plugging effect on the formation.
5. Cost should be no more than refinery residuals delivered on the lease.

Since the operator has the crude, all that is needed to build the ideal fracturing fluid is a chemical, to reduce fluid loss to a desired value, which the service company can furnish along with pump trucks and sand. In addition to reducing fluid loss this chemical should have the following properties:

1. It should require no additional mixing equipment beyond that already required for sand.
2. It should work equally well in oil which has been treated or not treated with emulsion breakers.
3. It should tolerate the small percentages of water sometimes found in crude on the lease.
4. It should be granular in form and conveniently packaged for easy handling.

Experimental

Our studies of fracturing fundamentals have resulted in the development of Adomite, an additive which meets all the specifications outlined above. It is available at the present time from a number of service companies. Its only limiting physical characteristic in field application is that slightly different concentrations are required to control the fluid loss of different crudes, necessitating pilot testing with each crude.

It will reduce the fluid loss of most crudes to less than 10 cc. when added

620 MILES OF ALASKAN PIPELINE —EVERY INCH A BATTLE

Temperatures of 60 below, muskeg, permafrost, snow, swamps, mountains—you get 'em all laying a pipeline from Haines to Fairbanks

UNDER THE MUSKEG, PERMAFROST. A Cleveland ditcher powered by a D8800 digs through a layer of muskeg and then through hard permafrost. A D6 is towing the ditcher while a Bucyrus-Erie backhoe, powered by a D315 Engine, backfills.

TWO LINCOLN WELDERS are mounted on a D6. In good weather the welding crews, seen here near Dot Lake, Alaska, have been averaging four miles a day.

Nature has been throwing the book at Williams Brothers Co. since December, 1953. On that date, the Tulsa pipeliners began working on the Haines to Fairbanks Pipeline, one of the most ambitious welded pipelines ever attempted.

It's been a grueling, ask-no-quarter test for crews and machines. But they're bringing the job in on schedule—these doughty pipeliners from all over the U. S. and their all-CATERPILLAR* fleet of pipelayers, 'dozers, engines and electric sets.

Clearing began in December, 1953, with snow drifted up to six feet and 15 days of temperatures ranging from 30 to 60 below. But D8s equipped with No. 8A Bulldozers cleared a mile a day, increasing to 2½ miles a day as weather improved. Covered at night with tarps and warmed by eight No. 2 kerosene lanterns, the CAT* D8 Tractors started easily each day.

In April, the first of five big yellow tractors plunged through the ice—only

(Advertisement)

IN A MUSKEG SWAMP A D6 equipped with a No. 6A Bulldozer backfills a trench. A D8 is being used as a stomper to hold down the pipe.

a few feet of its 22-foot boom showing. Recovered and flushed out, the D6 went back on the job with only a bent boom to show for its experience.

Half the Alaskan section of the line is underground. To tuck it in, Williams Brothers proved it was possible to dig permafrost with a ditcher. A D8500 powered the Cleveland ditcher and a lead Cat D6 dragged the ditcher more than 110 miles.

In the water-covered muskeg swamps there was a double problem. Under the moss-like muskeg lay permafrost. Skillful operators kept the big yellow tractors moving—although they might have been mired by the muskeg or slipped helplessly on the hard permafrost. But the Caterpillar D6 Tractors, with their oil clutches, kept production as high as 3500 feet of ditch in 24 hours. And only two clutch adjustments were required during the entire operation.

"Those oil clutches are giving awfully good service," reports E. M. Hubach, Superintendent of the Canadian section of the job. "Only one had a disc break and they've rarely been adjusted. Our Cat machines stay with us. They walk right through that muskeg."

The Canadian section of the job has a complete spread of Caterpillar-built equipment—eight pipelayers, four bulldozers, three tow tractors and two Cat powerplants on Bucyrus-Erie Shovels.

And each of the three comfortable crew camps for more than 300 men has been powered by Caterpillar D8500 Electric Sets.

The performance of all this equipment has proven once again that tough jobs are Caterpillar jobs.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS, U. S. A.

*Both Cat and Caterpillar are registered trademarks—®

ONE OF THE FLEET OF MD6s works on a bending operation in the Yukon. Bending crew has been averaging about five miles a day.

in concentrations of 0.1 lb. per gallon. Although the additive will meet these specifications with lesser amounts in some crudes, this concentration has proved best to insure proper mixing with field equipment.

Examples of how the material affects the fluid loss of kerosine and typical crude oil are shown in Fig. 2. This graph illustrates the effectiveness of the material in reducing the fluid loss of the oil from several hundred to less than 10 cc. at concentrations of less than 0.1 lb. additive per gallon of oil. All tests were conducted as specified by A.P.I. Code 29.

Crudes vary . . . Table 1 shows the results obtained with various oils treated with 0.1 lb. of additive per gallon of oil. As is evident from the table, crudes treated with equal amounts of additive do not show equal fluid loss. This indicates that each crude should be pilot tested before use and the available crude which yields the lowest fluid loss employed for the fracture.

We have found by field application that a fluid loss of below 10 cc. is generally acceptable. The recommended concentration of 0.1 lb. per gallon has always given us satisfactory results in the field even though tests have on occasion indicated a fluid loss slightly higher than 10 cc. Lesser concentrations were avoided in order to insure adequate mixing.

The additive has included in it chemicals which allow fluid-loss control in crudes containing as much as 2 per cent water. Field practice has shown that it is desirable to use only those crudes which are acceptable for delivery to pipelines.

Core tests . . . A series of tests were made to determine whether oil containing the additive would seal off a core and prevent fluid entry. Another important question was whether the initial permeability of the core would be regained by backflow of oil. The procedure used was as follows:

Core samples of varying permeabilities were prepared from Wyoming sands and alundum. Diesel oil and crude were flowed through the samples to determine their oil permeabilities. To the oil was added 0.1 lb. of additive per gallon and the flow of oil was continued to determine the reduction of flow. Following this, the clean oil without additive was reverse flushed through the cores and their permeabilities again determined. Results of these tests are given in Table 2.

Inspection of the results shows that the material when added to oil effectively seals off the core permeability and prevents oil entry. It further shows that this permeability block is temporary and is removed readily by backflow of oil through the core.

In field application as a fracturing-fluid additive, this material would seal off the faces of the fracture preventing the fracturing fluid's entry into the matrix. This sealing of the fracture walls would result in longer fractures from an equal volume of fracturing fluid since most of the fluid would be utilized in fracture extension. No trouble would be experienced in cleanup since the initial oil production would remove the "filter cake" from the fracture faces.

Field Tests

The first field test was made near Ardmore, Okla. Three zones, lower Tussey, Tussey, and Fusulinid, were fractured using lease crude containing the additive and 1 lb. per gallon of sand. The sand oil was preceded by 3 bbl. of crude and additive. Fluid loss of the fracturing oil was maintained below 10 cc. Treatment was 2,000 gal. of fluid and 2,000 lb. sand for the lower Tussey and Tussey, and 3,000 gal. of fluid and 3,000 lb. sand for the Fusulinid.

Adomite was mixed through the hopper on one treatment and premixed in a tank on another. In neither case was trouble encountered in the treatment and an injection rate of 3 bbl. per minute was maintained.

The viscosity of the crude oil with additive was 10 to 12 cp. No difficulty was experienced with sand settling in the well. All three treatments were conducted through a straddle packer with no tendency of the packer to hang after the treatments.

Production increased immediately from 8 bbl. to 49 bbl. per day. Since that time it has remained constant for 6 months at from 49 to 51 bbl. per day with no decrease.

Good results . . . As of the date of preparation of this report, Adomite has been used in over 150 wells. Results have been outstanding, with oil-production increases consistently larger than those obtained through the use of conventional fracturing fluids. These larger increases are attributed to longer fractures which resulted from confining the fracturing fluid to the fracture.

Table 3 gives several examples of field results. Of these treatments the material was mixed either with the sand through the hopper, premixed in tanks, or used with paddle mixers. Comparable results were obtained from all mixing methods.

Well C from the table was in a Kansas area where sandouts had occurred on all previous treatments. Before this attempt, the greatest amount of sand displaced before sandout using conventional fracturing fluids or thickened oils was 2,500 lb. With lease crude and Adomite, 6,000 lb. of sand and 6,000 gal. of oil were displaced without incident.

Production on this well was 345 bbl. of oil per day after conventional fracturing. This job illustrates further the importance of a low-fluid-loss fractur-

TABLE 1—EFFECT OF ADOMITE ON FLUID LOSS OF VARIOUS OILS

	Fluid loss*
Kerosine	8
Diesel	7
Wyoming crudes:	
Tisdale—Curtis sand	8
Meadow Creek—Tensleep	4.5
West Sussex—Shannon	10.6
Oklahoma crudes:	
Springer	8
Morton & Dotson	9.7
Hart	7
Kansas crudes:	
Geneseo—Arbuckle	5.5
Gerlane—Rhodes	7.0
Geneseo—Miss. Chat	5.0
Texas crude:	
North Cowden—Grayburg	3.5
Louisiana crude:	
VPU Tract 68A—Wilcox	1.6
California crudes:	
Turnbal—Clevenger	3
Bixby No. 3—San Gabriel	2
McGrath—So. Block Wasem	2

*A.P.I. Code 29; at 75° F. of oil plus 0.1 lb./gal. Adomite, cc./30 minutes.

TABLE 2—LABORATORY TESTS ON EFFECT OF ADOMITE ON CORES

Init. air permeability of core	Init. oil permeability	Per cent orig. flow rate after Adomite	Per cent original oil perm. after back flushing*
56.5	45.2	1.6	100
98.3	83.5	0.8	100
169	143	0.4	100
174	154	0.4	100
26.3	26.3	1.8	92
20.6	20.4	0.5	96

*With 100 cc. oil.

TABLE 3—RESULTS OF FRACTURING USING ADOMITE AND LEASE CRUDE

Well and formation—	Fracturing fluid, gal.	Sand, lb.	Injection rate, b.p.m.	Production, B/D			
				Before	After	30-60 Days after	6 Mo. after
A—Sand Andres	10,000	10,000	5	2	28	35	
B—Springer sand	6,000	12,000	3	8	49	51	51
C—Penn. chat	6,000	6,000	4	New zone	345 Flowing		
D—Gerlane	6,000	12,000	10	Dead	435		
E—Clear Fork	10,000	20,000	6	6		90	
F—Sussex "A"	5,000	5,000	5	4	53	45	52
G—Shannon B	3,500	3,000	12	50	239	180	99
H—Shannon B	4,000	3,000	9	20	79	67	51

ing fluid in preventing sandouts and creating longer fractures.

Perhaps the best example of the effect of low fluid loss was obtained from another Kansas well which was intentionally sanded out using untreated lease crude. Only 900 lb. of sand was displaced before sandout occurred at a pump rate of 4 bbl. per minute. An unsuccessful attempt was made to reopen the fracture using a conventional high-viscosity, high-fluid-loss fracturing fluid.

Crude oil having a viscosity of 12 cp. treated with the additive to give a fluid loss of less than 10 cc. was then used. The fracture was reopened and 5,000 lb. of sand pumped away at 3 bbl. per minute. This series of treatments offers considerable evidence that fluid loss is the governing factor in fracture extension.

Low pump rates . . . In addition to giving longer fractures for the same treating volume, the development of a low-fluid-loss fracturing fluid has eliminated the necessity of high pump rates which are prevalent in areas of West Texas. Field results have shown that large jobs, 20,000 gal. and over, can be achieved at pump rates of 6 to 8 bbl. per minute instead of the usual 20 to 50 bbl. per minute.

This results in savings to the operator since it reduces the amount of pumping equipment required. For example, a typical 20,000-gal. treatment might cost about $3,500 using Adomite plus oil, compared with $6,500 for the usual high-injection-rate job. These savings go directly to the operator who, at approximatly half the cost, obtains a better fracturing job.

The additive has been used both with and without viscosity builders. Added viscosity gives some insurance against sand fallout in case of mechanical failure necessitating a shutdown during the fracturing job, or in holes enlarged by SNG. Our field results have shown that viscosity does not appear to be necessary for extension of fractures in fracturing jobs up to 20,000-gal. treatments.

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BOOKS

FOREIGN OIL AND THE FREE WORLD. By Leonard M. Fanning. Published by McGraw-Hill Book Co., 330 W. 42nd Street, New York. 400 pp. $6.

This is the second edition of this volume, which is an up-to-date report on the international oil situation. The author, one-time public-relations director of the A.P.I., presents a vivid portrayal of the United States' stake in foreign oil and the efforts it has made and is making to protect that stake. He also analyzes the expropriation of Mexican oil lands, Venezuela's initiation of 50-50 profit sharing, and the diplomacy behind the 3-year Iranian oil dispute. The result is an easily read report on a subject of growing importance to American oil men.

PIPE FRICTION MANUAL. Published by The Hydraulic Institute, 122 East 42nd St., New York 17. 87 pp., $1.75 domestic, $1.85 foreign.

Material in this manual is an extension and rearrangement of the pipe-friction data contained in an earlier publication, "Tentative Standards of the Hydraulic Institute—Pipe Friction."

This data is based on the latest information available. The form of the manual follows a pattern developed as the result of numerous suggestions from users of the earlier publication.

The manual features a section demonstrating the mathematical calculations used in the construction of friction charts. This is supplemented by complete tables of friction loss for water in feet per 100 ft. of pipe. Wrought iron, steel, and cast-iron pipe sizes from ⅛ in. nominal to 84 in. i.d., are covered.

There are tables of resistance coefficients for valves and fittings, 90° bends, diffusers, and others. The tables of resistance coefficients for valves and fittings include the latest available experimental data and show the values in more detail with respect to size and type than has heretofore been published.

Full-page charts show the friction loss for the incompressible flow of viscous fluids for pipe sizes from ½ in. through 12 in. Also included are three fold-in charts of friction factors with related data to permit the calculation of the friction loss for any fluid (liquid or gas) in any size or shape of conduit.

Numerous examples show actual mathematical solutions to pipe friction problems.

SAMPLE DESCRIPTIONS AND CORRELATIONS FOR SELECTED WELLS IN NORTHERN ARKANSAS. Compiled by Mary G. Sheldon, USGS. Available from Arkansas Resources and Development Commission, Division of Geology, State Capitol Building, Little Rock. 222 pp. $2.

This is a compilation of key well data in northern Arkansas and is designed to assist in the search for oil and gas in the area. The report contains detailed descriptive logs that have been prepared from microscope examination of well samples. Sample tops are mentioned where it is possible to identify the formations. The report will serve as a basis for any geologist interested in making stratigraphic studies of northern Arkansas.

TECTONIC MAP OF THE COLORADO PLATEAU SHOWING URANIUM DEPOSITS. By Vincent C. Kelley. Published by Editor of Publications, University of New Mexico, Albuquerque. $1.

This excellent map of the Four Corners area of the Southwestrn Rockies shows the various structures of Utah, Arizona, New Mexico, and Colorado in brown. Uranium deposits are indicated by purple dots. Stocks, plugs, laccolith centers, and dikes are shown in red. Uranium deposits are indicated as three types: Morrision formation, Shinarump type, and others. Scale: 1 in. equals 16 miles. There are 94 structures listed in Colorado, 175 in Utah, 70 in Arizona, and 82 in New Mexico.

CORRECTION

C. S. Kenworthy, author of our article on reduction of compressor-station noise, May 16 issue, page 168, is general superintendent of compressor stations, Natural Gas Pipe Line Co. of America, Chicago. We inadvertently listed his affiliation as United Gas Pipe Line Co.

NELSON REFINERY CONSTRUCTION INDEX

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroeum refinery consultant, Tulsa.

The Index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

Index (1946 = 100)

	1948	1950	1952	1953	1954	Feb. 1955
Pumps, compressors, etc.	127.0	138.2	155.6	162.5	166.5	167.0
Electrical machinery	127.6	134.9	154.2	156.4	160.0	160.7
Internal-combustion engines	116.9	126.0	146.5	148.1	150.5	150.2
Instruments	120.0	127.8	146.2	151.8	154.6	158.1
Heat exchangers	130.0	140.0	165.8	174.9	171.7	152.1
Miscellaneous equipment average	*122.1	*126.2	153.3	158.8	160.7	157.6
Materials component	139.3	149.5	164.3	172.4	174.6	172.1
Labor component	128.0	144.0	163.1	174.2	183.3	186.2
Nelson construction index	132.5	146.2	163.6	173.5	179.8	180.6

*Used in computing the Nelson Index until April 1952. These are slightly different from the average of the Miscellaneous Equipment Items shown above.

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—7

What to Consider in Specifying Heat Exchangers

THERE are many forms of heat exchangers. They range from the simple pipe-within-a-pipe, with a few square feet of heat-transfer surface, up to the complex surface condensers with many thousands of square feet. In between these extremes is a broad field of common shell-and-tube exchangers, often specifically named by distinguishing design features. For instance, U-tube, fin-tube, fixed-tube sheet, and floating head.

One of the most widely used types is the floating-head exchanger. This type has great operating flexibility and lends itself to easy maintenance and repair.

Q. How is a shell-and-tube heat exchanger built?

A. Let us briefly look at the general construction and the nomenclature of a shell-and-tube exchanger. Fig. 1 shows sections of typical exchangers. The tube bundle consists of the tubes, the tube sheets, and the cross baffles. The channel at the front end of the exchanger serves as a header to feed the fluid into the tubes. The floating head at the back end of the tube bundle is the return header. It is free to move with the thermal expansion of the tubes. The shell unit is essentially a cylinder with a bolting flange at each end. The channel bolts to the front flange, and the shell cover bolts to the rear flange.

Q. How "standardized" is heat-exchanger construction?

A. Most manufacturers have standard lines of exchangers. The standards establish diameters and pressure classes, and promote the use of standard drawings and standard fabricating procedures. With standardization, the fabricator can cut down the time required for engineering and design, and so build exchangers faster.

Standardization does not mean that most exchangers can be delivered off the shelf. Service requirements vary too much. Some engineering is necessary for almost every exchanger and sometimes operating conditions require special exchangers. But if service conditions permit the use of exchangers built to standard lines, the buyer saves money.

Q. Why be careful in writing heat-exchanger specs?

A. Many users of heat exchangers have their own ideas about design and fabrication. They write specifications to insure that an exchanger meets certain minimum requirements. But the owner must use care in the preparation and in the application of these specifications. They must be complete, detailed, and specific if they are for equipment purchased from a job shop that has no design engineers and makes no performance guarantee. But if they are going to a completely equipped exchanger fabricator, the specifications should allow some freedom.

The owner can then benefit from the fabricator's know-how and experience. And he benefits from the two advantages of a standard exchanger, lower cost and interchangeability. Small deviations from the manufacturer's standard line can increase exchanger cost greatly. The manufacturer's standard almost always meets the requirements of the customer.

Q. What information should you give when requesting bids on heat exchangers?

A. The engineer who selects and designs heat exchangers is an expert in the field. Often he has had plant operation experience. He can usually recommend the best type of equipment for each individual case. Sometimes he can save the purchaser a great deal of money. But before he can make suggestions, he must know the process conditions.

Too often inquiries for exchangers do not include enough information. Even people who are completely familiar with bid requests sometimes omit important data. Seemingly small omissions can affect the exchanger selection considerably. The following two paragraphs give the basic process information required.

. . . Process information. The heat exchanger inquiry should include these things: fluid quantities; fluid temperature in and out; quantity vaporized or condensed, if any; operating pressure; allowable pressure drop; and the fouling-factor required. The heat load is not necessary with the other information, but it is well to include it.

By checking the heat load, the process designer may uncover some process errors. If the fluids are uncommon, the properties needed to predict heat-transfer rate should be included. These are specific heat, density, viscosity, and thermal conductivity. Any other process information available may help the process designer arrive at the best and most economic selection.

(Continued in the next installment)

Material from paper, "Design Features in Heat Exchangers," by W. E. Glausser and J. A. Cortright, C. F. Braun & Co., Alhambra, Calif. Paper presented at annual meeting, A.S.M.E., New York.

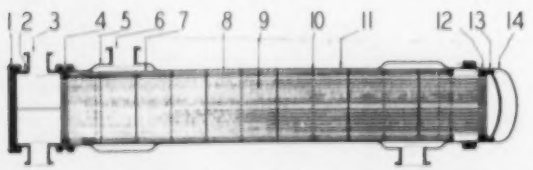


FIG. 1—Cross-section of a pull-through-type heater exchanger detailing: (1) channel cover; (2) channel; (3) channel nozzle; (4) channel tube sheet; (5) annular distributor; (6) shell nozz'e; (7) distributor sleeve; (8) tie rods; (9) tubes; (10) segmental cross-baffle; (11) shell; (12) floating-head tube sheet; (13) floating head; and (14) shell cover.

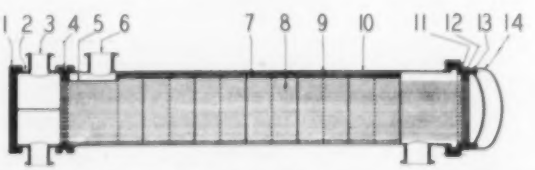


FIG. 1-A—Cross-section of a split-ring-type heat exchanger showing: (1) channel cover; (2) channel; (3) channel nozz'e; (4) channel tube sheet; (5) impingement baffle; (6) shell nozzle; (7) tie rods; (8) tubes; (9) segmental cross-baffle; (10) shell; (11) floating-head split ring; (12) floating-head tube sheet; (13) floating head; and (14) shell cover.

by N. E. van Fossan

UNDERGROUND STORAGE—2

Disposing of Brine and Washing the Well

TWO vital questions must be answered in the initial stages of developing an underground storage well. First, how will you dispose of the brine? And second, how will you wash the well?

How to dispose of brine is one of the most difficult of all the problems associated with underground-storage development. Several methods are now being used for the disposal of brine. Disposal wells are being drilled into sections of high porosity and permeability or in cavernous sections generally associated with the salt-dome type of operation. Disposal wells may be used to supplement other water supplies in the flooding of adjoining oil fields.

A step development of an underground-storage well may be carried on concurrently with a disposal well. The disposal well is sometimes drilled into the loss-of-circulation zones in such way that it may be later recompleted as a storage well.

Disposal wells have a further advantage in economical use of land area. Several disadvantages are that the initial cost, maintenance, and workover of the well is exceedingly high. There are dangers of bridging the loss-of-circulation zone and losing the facility. It can never be known at what time this will occur, nor at what rate a proposed disposal well will carry off the brines.

Then there is always a possibility of charging fresh-water sands in the immediate vicinity of a disposal well with salt water. It is also evident that if brine is dumped to a disposal well, it will not be available for use in the recovery of product. Then, as a consequence, fresh water must be used.

By evaporation . . . Brine is disposed of by evaporation in many West Texas operations. This has several obvious advantages. Large brine-storage pits are the only facility necessary. Brine will be available for regeneration of zeolite treaters, for sale, and for the recovery of product whenever storage chambers have reached capacities beyond which no increase is desired.

Author is with Texas Natural Gasoline Corp., Tulsa. Paper presented at N.G.A.A., Dallas meeting, April 13-15, 1955.

Evaporation pits have several disadvantages. The biggest one is that evaporative rates are dependent on atmospheric conditions. This will limit the usage of evaporative pits to arid regions. Considerable land space is required because the surface area of the evaporative pit must be big enough so that brine-disposal rates by evaporation will not limit brine-production rates.

It is extremely difficult to build pits which will not leak by seepage. High winds associated with the West Texas area and consequent wave action on the side walls of the pit are conducive to breakouts. A sudden flood of 100 per cent saturated salt water over the verdant pastures of the West Texas ranchmen is frowned up. Salt precipitation will occur in the pits due to the evaporation, and over periods of time this salt must be removed to maintain volume space.

Into rivers . . . Some brines are being disposed to rivers and streams. The obvious advantage in this method is low cost and ease of handling, and the disadvantages are just as obvious. Regulatory provisions on permissible parts-per-million concentration of salt water in fresh-water streams, are sometimes rather rigid. As a consequence, auxiliary pits must be constructed to take care of brine production during periods of low river levels. It is also evident that no brine will be available for recovery of stored product using this method. Disposal of brine to ocean areas has great advantage in low cost and utility, and there are no great objections to this type method in that brine is being dumped to an already unusable fluid. Naturally, recovery brines will not be available.

When the time has come to actually drill the well, very careful procedures must be initiated and carried through with fine detail. Drilling techniques are quite similar to normal oil-field procedures. The main difference is that larger casing strings are generally used, that greater care is used in picking casing seats, and that very careful procedures are used in the cementing of all casing strings.

The characteristic of all insoluble stringer should be investigated in relation to their structural strength, porosity and permeability. Washing procedures should be started to take

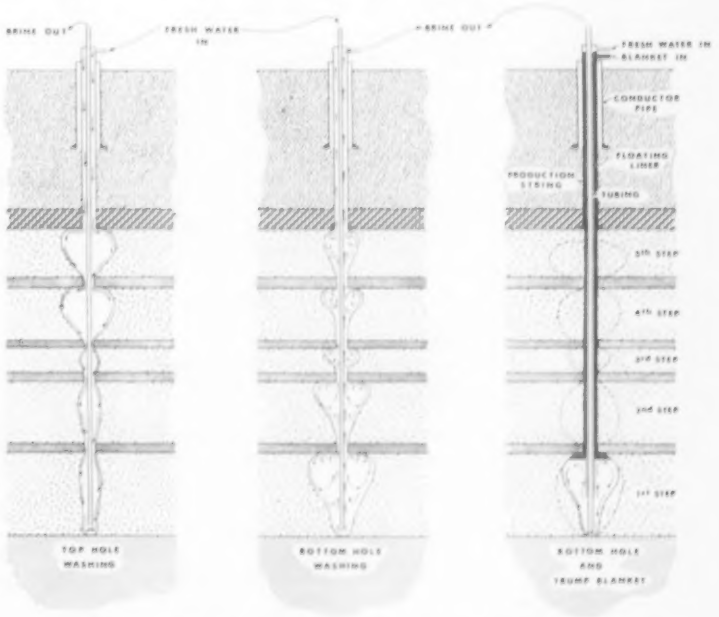


Fig. 1—How salt beds are washed prior to product storage.

maximum advantage of the most likely soluble sections. Careful thought should be given to the possibility of stringer failure and to the effect of stringer configuration on lateral extension of an individual chamber, in the light of possible communication with an adjoining storage cavern.

Washing

After the hole has been drilled and it is believed that the area to be used for the storage cavity is indeed practical, attention should be turned to the problem of proper mechanics of washing the area. That is, the pumping of fresh water into the proposed storage area and thus removing the salt by solution. Several washing theories exist and will be discussed in detail. Each has its own time and place of application.

Top-hole washing . . . A storage chamber may be washed by top-hole washing, bottom-hole washing, a combination of top and bottom-hole washing, or by U-tubing two separate wells (see Fig. 1). Top-hole washing presupposes that the production casing string will be set in a completely impervious, structurally strong formation and that the cement job will be perfect.

In this procedure, a tubing string is run into the open hole to the bottom of the proposed storage section. Fresh water is introduced down the casing string and enters the storage area immediately under the capping formation (see Fig. 1). From that point it descends past the exposed soluble section until it has reached the end of the tubing (at total depth) and returns through the tubing to be disposed of at the surface.

This type washing procedure has an advantage in that the washing media will be saturated early and well and will permit highly effective washing. The well may be pumped at a high rate and still maintain washing efficiency. All soluble sections are washed in one operation, though the lower sections will be developed to lesser extent than the first soluble formations encountered. This method is especially good in areas where only thin salt sections are available, or in other areas where you want to develop only one section (of an existing series of salt layers) which may lay between two heavy impervious geological members.

Certain disadvantages may also be attributed to this particular washing procedure. And, since these disadvantages are critical, careful study should be given to the particular storage well in question. If the disadvantages outweigh the advantages, other washing procedures should be used.

The main disadvantage to top-hole washing is the required structural strength of the capping formation. It must be homogeneous within itself and must be thick and impervious. If it isn't, washing procedures allowing introduction of fresh water immediately under the capping formation will undermine that formation to such a point that it will collapse.

It is also evident (see Fig. 1) that the peculiar hole shape associated with top-washing will allow any caving material to sweep immediately across the bore hole (which exists in roughly its original diameter through insoluble stringers) As a result, major troubles will come with both removal of the old tubing string and with the attempt to introduce a new tubing string into the hole. Troubles of this nature require a workover of the well. It is extremely difficult to drill through or properly pulverize any obstruction existing across the bore hole in the funnel-shape cavity shown.

As mentioned before, the washing will be nonselective. Instead of developing storage space in the various soluble sections in advantageous proportions, the top soluble section will be developed to maximum extent. The various other sections going toward the bottom will be progressively smaller until little washing action, other than a mechanical washing effect due to velocity and abrasion, will be available at the end of the tubing.

Another disadvantage is that possible faults in the capping media may exist at some point remote from the bore hole so that large lateral development of the top soluble section will result in eventual communication with the fault zone. When that happens, the complete storage chamber is made unusable.

Bottom-hole washing . . . These techniques here are similar as far as casing and tubing programs are concerned. The basic change is that fresh water is introduced down the tubing while salt water returns through the casing. Less stringent requirements on the capping formation may be allowed, and some progressive development of exposed soluble sections may take place (see Fig. 1).

Since the fresh water is lighter than brines contained in the hole, it will have a tendency to rise until it hits the first impermeable section. At that time, it will flow to the original bore hole, go through that bore hole, rise across the second soluble section and thence through the bore hole into the next insoluble section, etc., and thus to the undersurface of the main capping media.

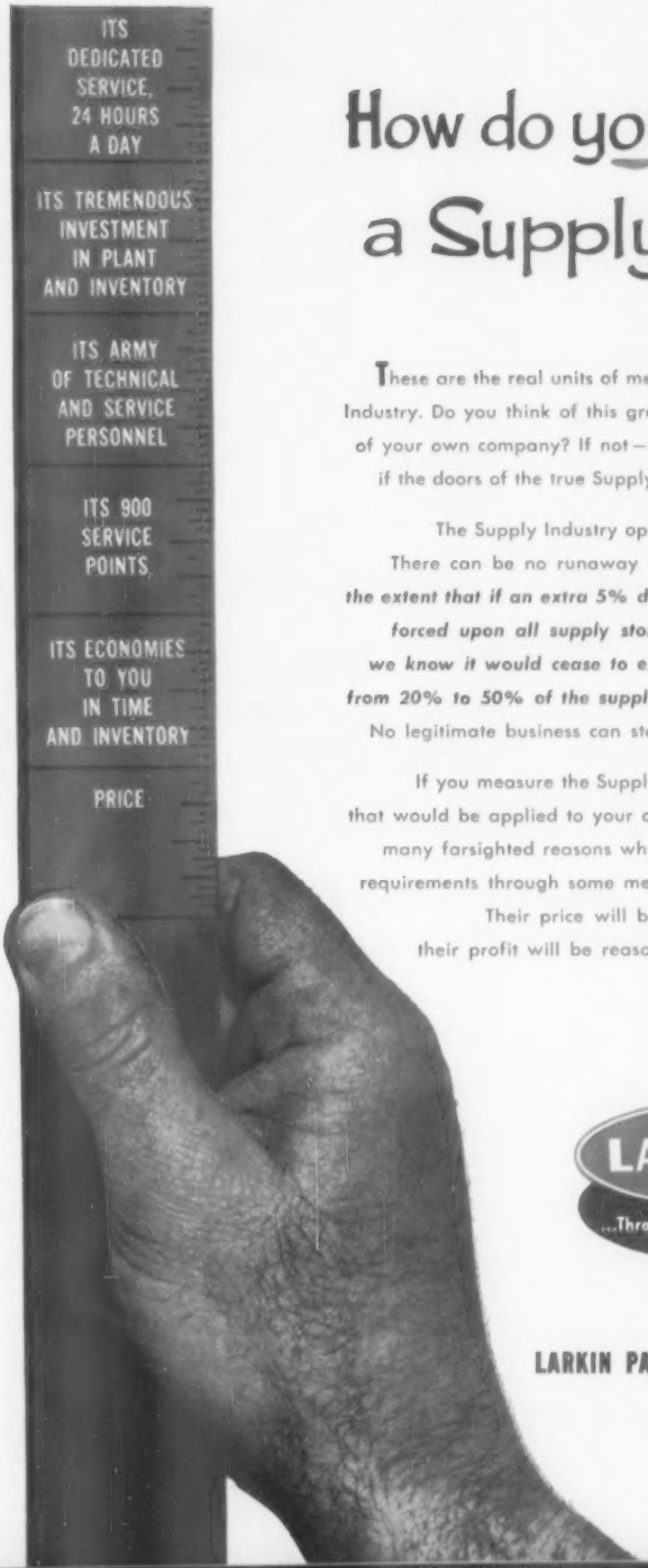
It can be seen by this method that progression of developed space will now be from bottom to top. That is, the bottom chamber will be larger, the second chamber slightly smaller, etc. This method is inefficient in that more time will be required to bring the brine up to saturation because of the very fact that fresh water will float and will have no mechanical means (for example, displacement - pressure movement) of being forced into contact with all surface areas of the soluble material.

After enough salt surface area has been developed to maintain complete saturation of the recovered brine, flow rates must be kept within the limits of those surface areas so that valuable fresh waters will be fully utilized in the removal of the salt.

Trump blanket . . . The washing method which probably has the greatest advantage and utility, involves running an auxiliary liner to a predetermined depth (this casing string is generally known as a "floating liner" and is hung in the tree—it is not cemented) which depends on proposed cavity development. The tubing string is run through this liner and, as a further precaution, a hydrocarbon blanket (either butane, propane or diesel oil) is added between the production casing string and the floating liner (see Fig. 1).

This is known as "trump" blanket method. It was used to recover salt brines in a similar washing operation in the early 1900's. Enough blanket is introduced into the hole so that only those soluble sections desired may be washed at one time. Extension may thereby be done in one section. And, by lifting the floating liner to a higher section and reintroducing the trump blanket, the second section may be developed to the point desired. Then the floating liner is lifted and the procedure repeated.

The main disadvantages of this method of washing are similar to those of the bottom-hole washing method.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Here is one of the biggest refineries on the East Coast. It is Esso Standard Oil Company's 244-acre operation on tidewater at Baltimore, Md. In the distance, close by docks which receive tankers from the Gulf Coast, Aruba and Venezuela, can be seen some of the towering refinery structures.

Among Esso's production units—all completely modern—are an atmospheric pipe still, a fluid catalytic cracking plant, a gas-compression plant and an alkylation unit. With a normal crude run of 60,000 barrels per day, the refinery's output consists primarily of automotive and aviation gasolines, fuel oils, diesel oil, asphalt, and a variety of lubricants. The refinery serves as a central distributing point for the marketing of these products throughout the states of Delaware, Maryland, and West Virginia, as well as in the District of Columbia.

A refinery of this size needs plenty of storage capacity. Over 2,000,000 barrels of the storage here is supplied by big Bethlehem Cone-Roof Tanks, all of 96,000-bbl-capacity. These 22 whoppers, including two under construction, appear in the foreground of the photograph.

Perhaps you would like to know more about Bethlehem Oil Storage Tanks. We recommend our informative Booklet 298 which describes the construction features of floating-roof, lifter-roof and cone-roof tanks of Bethlehem design. Please write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa. And for the best first-hand information you could wish, we suggest you call or write the Bethlehem sales office nearest you.

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Pumping of Cold Viscous Crude Not Feasible

"We, as pump builders, were much interested in your answer on how to handle viscous crude oils. Your statement that the use of pressure alone as a means of handling viscous oils is not feasible agrees with our thinking, but if you have more information we shall appreciate receiving it."—W.I.P.

Even a fairly viscous fluid causes such a large pressure drop in conventional diameters of lines that the pump and line could not be built to withstand the pressure. Thus, for a 4-in. line operating at a conventional velocity of 1.7 ft. per second, the pressures required for pumping oils of various viscosities are about:

Viscosity S.U.s.	Pressure drop, psi.
100	50
2,000	595
5,000	13,200
10,000	27,250

This, of course, is simply relative to a particular setup in which the 100-viscosity oil can be pumped at a pressure of 50 psig. Pressures of 2,000 psi. and higher are obviously not feasible, but two alternatives are available in handling the most viscous oils. Either a larger line can be used or the oils can be heated to temperatures such that their viscosities are reduced (100 seconds requires 220°, 247°, and 270° F., respectively). Although the cost of heating the oils is very large (1.1-1.5 cents per barrel for one heating), the investment that would be tied up in a larger line is also significant. Note also that even a 6-in. line would create too much pressure drop if the necessary working pressure were above about 100 psi. rather than the 50 psi. used in the illustration.

Every situation requires its own analysis, but the same general pattern appears in every case if a wide range of viscosity is considered. The methods available for pumping viscous oils arrange themselves as follows:

Situation—	Method
Slightly high viscosity	Pressure may suffice
Moderately high viscosity	Larger lines may be feasible
High viscosity	Heat the fluid
Semisolids	Both heat and use a large line

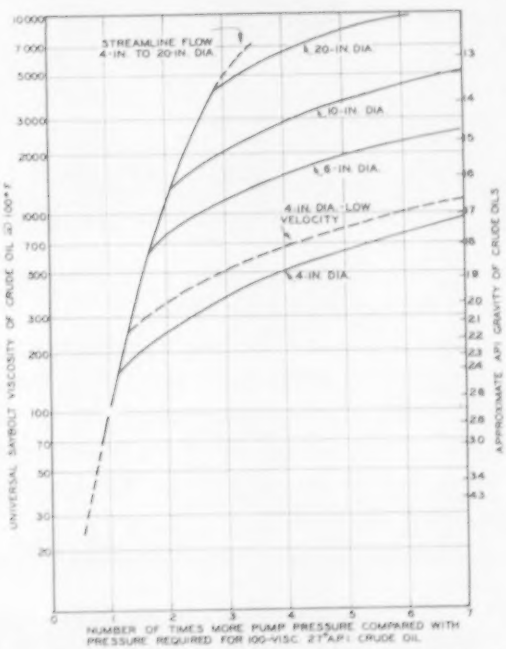

STREAMLINE FLOW 4-IN. TO 20-IN. DIA.
8, 20-IN. DIA.
10-IN. DIA.
6-IN. DIA.
4-IN. DIA.-LOW VELOCITY
4-IN. DIA.
UNIVERSAL SAYBOLT VISCOSITY OF CRUDE OIL @ 100° F
APPROXIMATE API GRAVITY OF CRUDE OILS
NUMBER OF TIMES MORE PUMP PRESSURE COMPARED WITH PRESSURE REQUIRED FOR 100-VISC. 27° A.P.I. CRUDE OIL

Fig. 1—Pump pressures when handling viscous crude oils compared with pressures for a nonviscous (27° A.P.I.) oil.

When handling viscous crude oils in gathering and cross-country lines, the effect of viscosity on pressure drop is somewhat as indicated in Fig. 1. Approximate gravities of the crude oils are also shown (see Questions on Technology, November 8, 1954, p. 192, and November 15, 1954, p. 269). The several lines of Fig. 1 are based on economical capacities (for nonviscous oils) except for the extreme shown for a 4-in.-diameter line operating at a low velocity (see Table 1).

Fig. 1 shows that as long as the flow is in the "streamline" region, the effect of increase in viscosity is substantially the same in all diameters of lines. At higher velocities (turbulent flow), increase in viscosity results in sharply increasing pressure drops relatively to the pressure drop with a nonviscous fluid (100 S.U.s. at 100° F.), and of course, a pattern of line sizes develops. An extension of Fig. 1 indicates the need of enormous pressures (10 to 1,000 times normal) when handling viscous crude oils.

The heating of viscous crude oils was discussed in the November 15, 1954, issue of this page ("How to Handle Viscous Crude Oils").

TABLE 1—APPROXIMATE CAPACITIES FOR THE LINES OF FIG. 1

Diam., in.	Velocity, ft./sec. at 60° F. Used	Velocity, ft./sec. at 60° F. Range	Economical cap., B/D
4	1.7	1.1-2.4	2,300
6	3.0	2.1-4.1	9,000
8	3.4	2.4-4.6	18,000
10	3.8	2.7-4.9	32,000
12	4.1	3.0-5.1	50,000
16	5.1	3.7-6.4	110,000
20	6.0	4.4-7.5	200,000

Smoke Tests Explained

"We are confused about the smoke point and other tests about smoking, such as smoke tendency and smoke volatility index. Can you explain the differences?"—G.I.P.

The most widely known smoke point is the height in millimeters of flame that can be obtained in the special Smoke Lamp Institute of Petroleum (Specification I.P.K. 36).

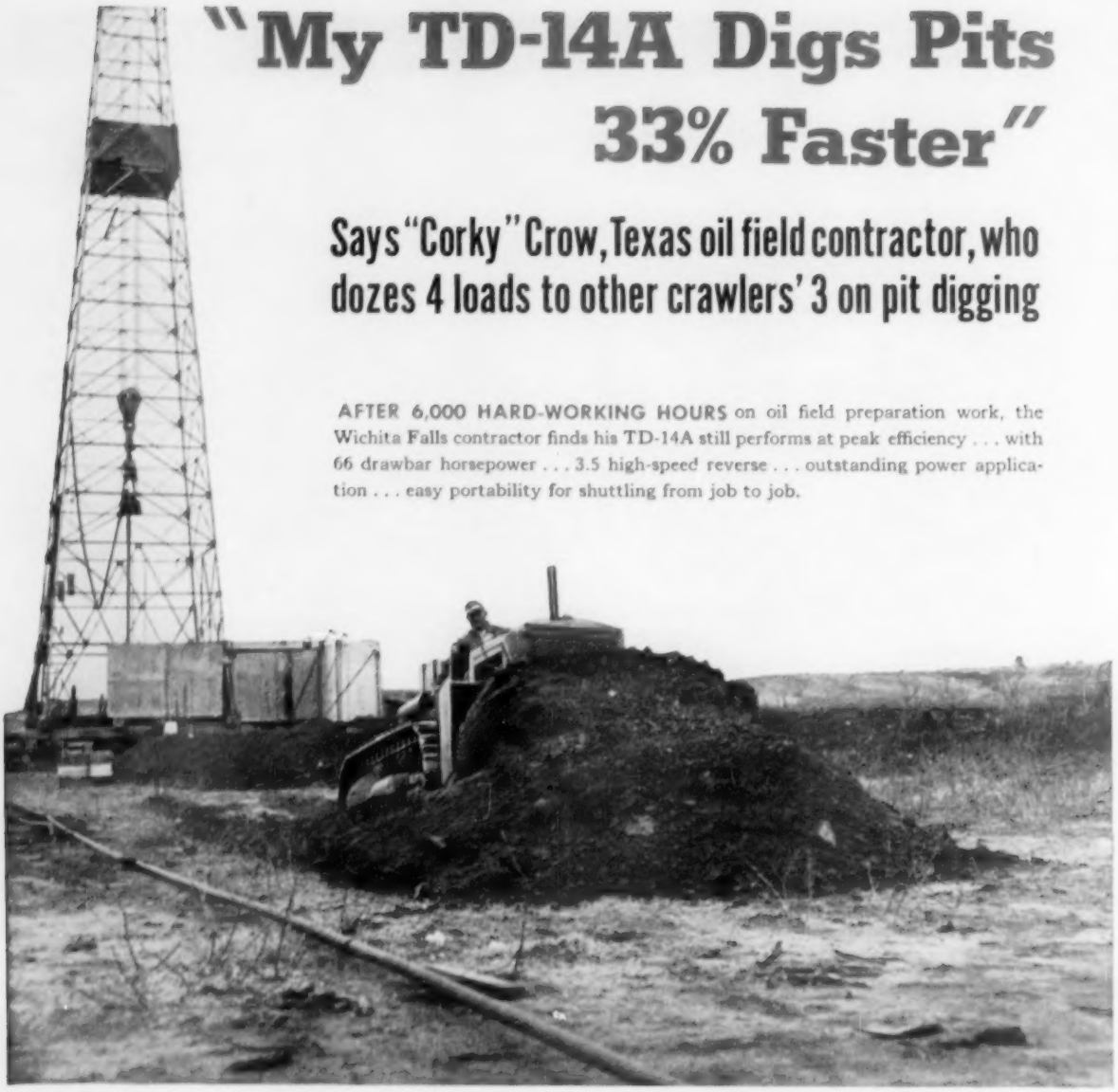
A possibly useful modification is the smoking tendency which is simply the reciprocal of smoke point multiplied by 320 (usually). It provides large numbers for "smoky" fuels whereas the smoke point gives low numbers for the bad or smoky fuels.

Still another modification is the smoke volatility index used in the recent specifications of JP 3 and JP 4 fuels, and it should not be used for fuels of greatly different volatility than conventional JP 3 or JP 4. It consists simply of the smoke point plus 0.42 times the percentage distilled at 400° F.

"My TD-14A Digs Pits 33% Faster"

Says "Corky" Crow, Texas oil field contractor, who dozes 4 loads to other crawlers' 3 on pit digging

AFTER 6,000 HARD-WORKING HOURS on oil field preparation work, the Wichita Falls contractor finds his TD-14A still performs at peak efficiency . . . with 66 drawbar horsepower . . . 3.5 high-speed reverse . . . outstanding power application . . . easy portability for shuttling from job to job.



In the booming oil fields around Wichita Falls, Texas, oil field contractor E. C. "Corky" Crow works his two INTERNATIONAL TD-14A tractors alongside other makes of crawlers.

Here's what he says about oil field crawlers:

"I come out of the pits with 4 loads with my TD-14As when other tractors working alongside only get 3 loads—a 33 percent bonus. I can move my TD-14As around from one job to another in a small truck at low cost. And they both have the guts to outwork anything of the same size. Give the drilling company a chance to choose a tractor for the job and mine are the ones they pick. Many a time I had to thank my IH crawlers for extra hours and days of profitable work."

That's one man's experience with INTERNATIONALS in the oil field—and your INTERNATIONAL Industrial Power Distributor would sure like to get yours. He'll demonstrate anywhere and any time you say so you, too, can see what "Corky" Crow was talking about. Call today.

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ELECTRIC LOGGING—60

Interpreting Typical Field Logs

FIG. 1 shows an induction log and gamma ray taken in 1 Berry, Glasscock County, Texas. This well was drilled into the upper Spraberry formation with cable tools, so that these logs are a good combination to use.

The upper Spraberry is composed of relatively thin alternations of limestone, shale, calcareous shale, and sandstone.

Oil sand is recognized by low radioactivity and resistivities ranging from 4 to 25 ohm-meter.[31] In general, resistivities will vary inversely with porosity. Higher resistivities correspond to lower porosities and vice versa.

An upper limit is placed on the resistivity because limestone and sandy limestones, both with very low porosity, will display higher resistivity values, but will not yield production.

The best indications of production in 1 Berry are sands at 6,910, 6,920, and 6,990 ft. Production may be improved in general by Hydrafrac treatment. In this case, however, no control was used during such a job. A packer was set inside the casing and pressure applied to the whole section shown on the logs. No commercial production was obtained before or after the job.

The writer considers that straddle packers should have been used to confine the Hydrafrac treatment to the sands at 6,910 and 6,920 ft., which appear to offer the best prospects of production in this well. It is impossible to create more than one fracture, so that with all the hole open, the fracture may occur anywhere in the section and not necessarily in the producing sand.

Fig. 2 shows a comparison of gamma-ray logs run in the same well, 1-A Houston "R." In the section from 12,150 to 12,300 ft., both time constant and logging speed are the same, 8 seconds and 25 ft. per minute respectively. The logs differ in detail and the maximum difference has a constant value. This illustrates the statistical variation which occurs in logs of this type.

In the section from 11,700 to 11,850 ft., the solid curve was obtained with the same time constant and logging speed as before. The dotted curve was obtained with a very much smaller time constant of 5 seconds, and a slightly higher logging speed of 30 ft. per minute. Comparison of the two logs suggests that a logging speed of 25 ft. per minute is too high for a time constant of 8 seconds. Although the solid curve shows a lot of detail, main features are smoothed out.

Fig. 3 compares core data with an electric log. The area shaded with vertical lines shows that porosity is reasonably uniform throughout. In contrast, the area shaded with horizontal lines shows that permeability is variable. At first sight, there is a general agreement between permeability and the S.P. curve. It is emphasized, however, that this is not a direct relationship. Lower permeabilities are probably caused by an increase in clay content, and this larger clay content results in a lower S.P.

Referring to the other side of the log, solid black shows residual oil saturation, the stippled area indicates residual water saturation, while the diagonally shaded area represents the salinity of water in the cores. Both core data and resistivity curves show that an oil-water contact has been penetrated.

(Continued in the next installment)

Author is assistant professor of petroleum engineering, Missouri School of Mines and Metallurgy.

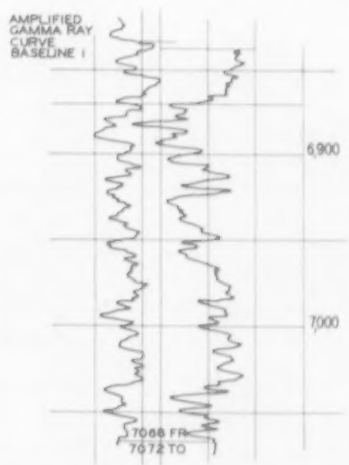

Fig. 1—Induction log and gamma-ray log taken in 1 Berry, Glasscock County, Texas.

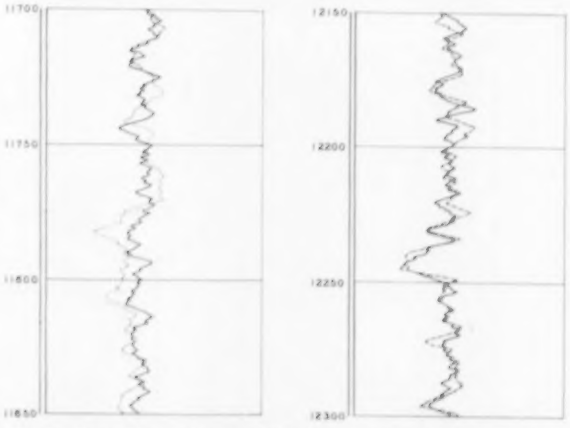

Fig. 2—Comparison of gamma-ray logs run in Phillips' Houston R 1-A at Chocolate Bayou field, Texas.

Fig. 3—Comparing core data with an electric log. The vertical shading shows where porosity occurred.

Attention, producers: profit Adomite*

What it is. Adomite is a newly developed and *thoroughly tested fluid-loss control additive* for converting lease crudes to superior fracturing fluids.

What it does. Adomite effectively seals the fracture face and practically prevents loss of fluid into the producing formation. This results in longer fractures and deeper penetration of sand for a given job. Adomite also cleans up rapidly and does not contaminate the produced oil or the formation.

How you profit. You get *greater sustained production* with a given fluid volume *at much lower cost*. Adomite may also enable you to make significant fractures in formations which have proved difficult to fracture with conventional techniques.

Form and availability. Adomite is a dry material in flake form now available through fracture service companies.

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Adomite is equally effective in oils which have or have not been treated with emulsion breakers. It will tolerate small percentages of water sometimes present in crude on the lease and has little or no effect on viscosity of the oil. When Adomite is used, neither the formation nor the well's early production is contaminated with heavy residuals.

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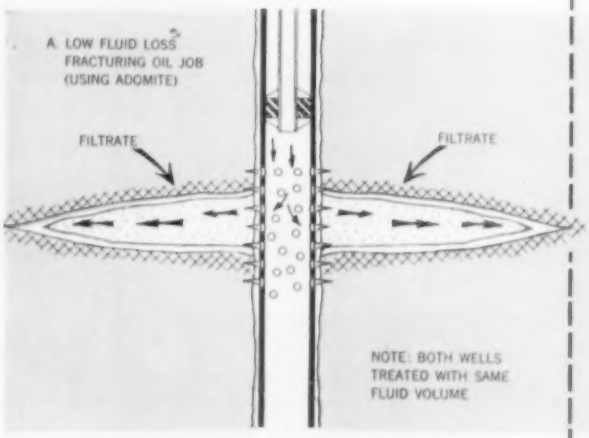

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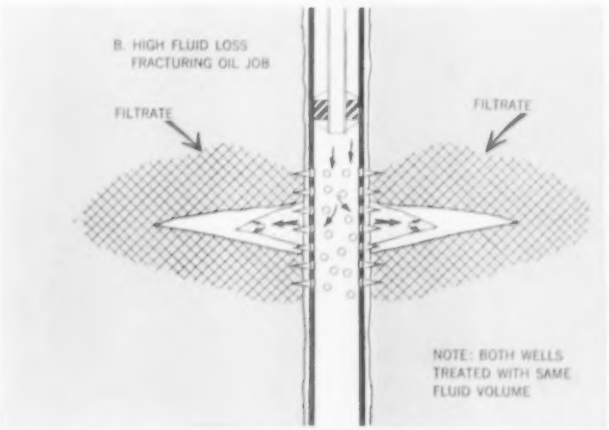
1. Sustained Fracture Production—*Oklahoma.* First well fractured with Adomite in June, 1954. Production increased from 8 to 50 BOPD. Production 10 months later still 50 BOPD. *Wyoming.* Well fractured with 5,000 gallons Adomite-treated lease crude and 5,000 pounds sand. Production increased from 25 to 40 BOPD immediately following fracture. Six months later production was 65 BOPD.



2. Increased Production—*West Texas.* Well fractured with 10,000 gallons Adomite-treated lease crude and 20,000 pounds sand. Production increased from 75 to 576 BOPD.

3. Refracturing—*Kansas.* Well fractured with 10,000 gallons Adomite-treated lease crude and 12,000 pounds sand. Flowed 216 BOPD. This was third time well had been fractured, the two previous times having been with conventional fluid. Well had been shut in before fracturing.

4. Difficult Treating Area—*South Louisiana.* Well fractured with 10,000 gallons Adomite-treated lease crude and 10,000 pounds sand. Production increased from 0 to 160 BOPD. Previous fracturing in area sanded out at less than 2,000 pounds sand with conventional fluid.

5. Reduced Treatments—*West Texas.* In a field, 10,000 gallons of Adomite-treated crude oil injected at 8 bbl./min. gave as good, or better, results than were obtained in offset wells treated with 20,000 gallons conventional type fluid, injected at 40 bbl./min.

6. High Bottom Hole Temperature—*South Texas.* Adomite-treated lease crude has been used to put away 6,000 pounds sand in a formation having a temperature of 245°F. Ordinary fluids break down at this temperature.

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Ask your service company to use Adomite on your next fracture job

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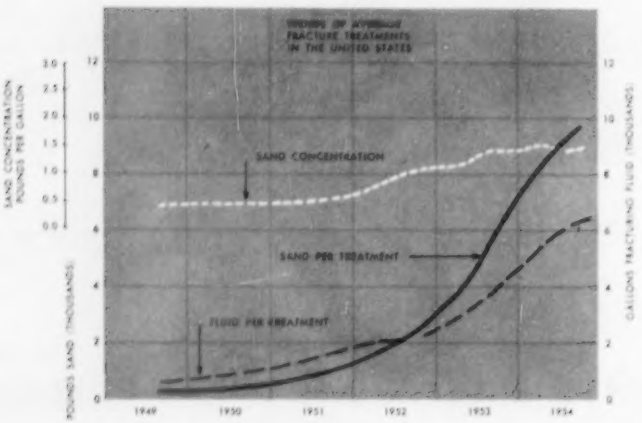

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1

Operation is continuous, limited only by the availability of fracturing fluid and sand.

2

Constant ratios are maintained within narrow limits although rates of mixing may vary over wide ranges.

3

Ratio of sand and oil can be quickly changed at any time by manipulation of a simple control.

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Among the Drilling Contractors

Longview Contractor Moves

Trans-Tex Drilling Co., Longview, Tex., contract-drilling and operating company, is moving its headquarters to Shreveport. Controlling ownership of the company recently was acquired by Husky Oil Co., of Cody, Wyo. W. O. White is president.

W. C. Fatjo Drilling Co., Lafayette, La., has a new wildcat operation under contract for Grubb & Hawkins, of Houston. It will be a Tweedel-sand test about 2½ miles southwest of Wilburton, in Jefferson Davis Parish, Coastal Louisiana. Location, at 1 Bruchaus, in 4-7s-3w, is about 2 miles south of North Elton field, in Allen Parish. Contract is for 8,800 ft.

Makin Drilling Co., Hobbs, N. M., is moving a heavy rig to a new location a mile west of Eidson-Pennsylvanian field, 9 miles west of Lovington, in Lea County, New Mexico, where it will drill for Cities Service Oil Co. at 1 York, a projected 11,000-ft. test to the Devonian. Location is in 12-16-34.

New Drilling Co., Denver, has a new wildcat operation under way 6 miles south of Oshkosh, in Garden County, Nebraska. It is a contract job for Calstar Petroleum Co. at 1 Hendrickson, in 28-16n-44w.

Sunnyland Contracting Co., Rayne, La., is scheduled for a deep test to be drilled for Sohio Petroleum Co. and Gulf Refining Co. at an outpost location a mile southeast of the multiple-pay Washington field, in St. Landry Parish, South Louisiana. Location for the step-out is listed as 18 Thistlethwaite, in 32-4s-5e.

Great Western Drilling Co., Midland, Tex., is contractor and joint operator with R. S. Brennand, Jr., on a 3,000-ft. Entrada test being drilled in the Cisco area, 7 miles northwest of Harley Dome, in Grand County, Utah. Location is at 2 Federal, in 25-18s-24e.

Tri-State Drilling Co., Laurel, Miss., is scheduled for a deep test to be drilled for R. M. Moon, also of Laurel, 1 mile southeast of Sandy Hook field, in Pearl River County, southern Mississippi. Hole is projected to the lower Tuscaloosa formation with a depth of about 9,100 ft. anticipated. Location is for 1 Janie Smith, in 5-1s-17w.

Brewster-Bartle Drilling Co., Houston, has a new deep-drilling contract in St. John the Baptist Parish, southern Louisiana. It will be a 13,000-ft. test for Herman Brown, of Houston, at 2 Bowie, located in 33-13s-18e, in the extreme southern part of the parish, near the Lafourche Parish line. Location is about 1½ miles northeast of the old Kraemer field, in Lafourche Parish.

Vasser & Brown, Inc., Natchez, Miss., is under contract for a rank wildcat test to be drilled for Central Oil Co., of Laurel, Miss., in northwestern Mississippi's Bolivar County. It will be a Paleozic test. Planned depth is about

Crewmen on a rotary rig Musgrove Petroleum Co., Wichita contracting and operating company, is running on a wildcat test, its 1 Hayter, in Harper County, Kansas. Left to right: Glen Wood, floorman; Darrel Heape, engineman; Dale Bullen, derrickman; and Robert Hart, driller.

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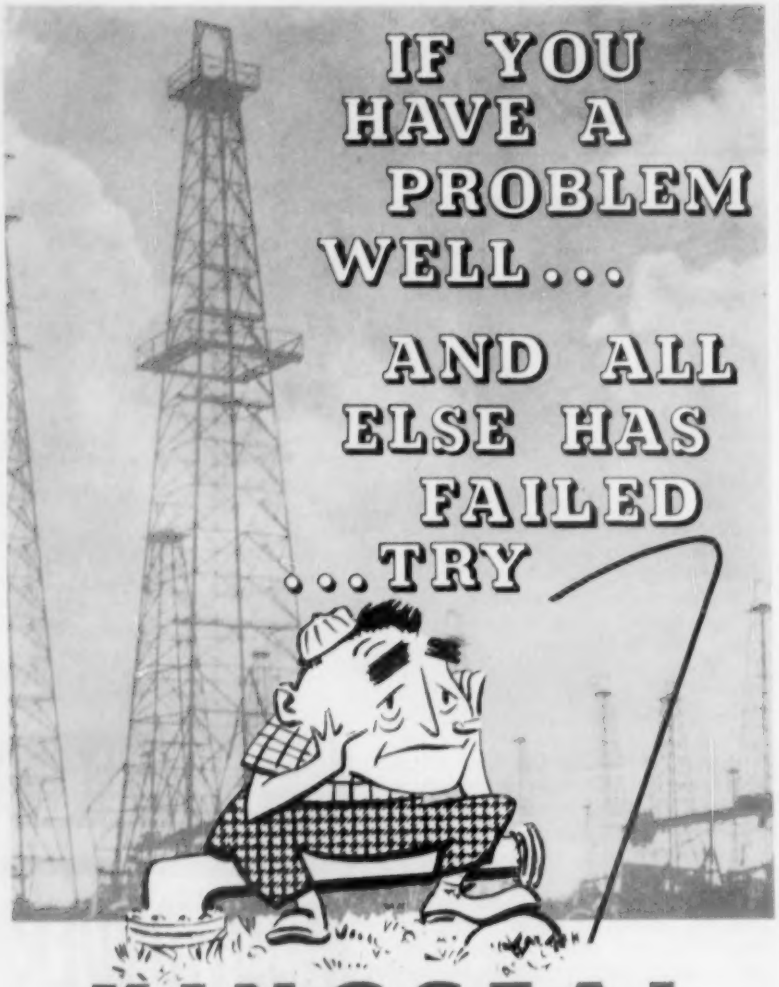

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6,000 ft. Location, listed as 1 Tuminello, in 14-24n-7w, is 8 miles northeast of Rosedale. Nearest production is 90 miles to the south in Tinsley field, Yazoo County.

Kulberg & Otthouse, Inc., Cut Bank, Mont., is contractor on De Kalb-Northern Oil Division's new Madison wildcat test 6 miles northeast of Joplin, in Hill County, Montana. Objective is expected around 3,800 ft. Location is at 1 Haaland, in 14-33n-8e.

Gilger Drilling Co., Houston, is starting a new deep test for Pan American Production Co. in the Church Point area of Acadia Parish, South Louisiana. It is a step-out location at 1 Matte, in 1-8s-2e. Hole is projected to the Nodosaria sand below 10,000 ft.

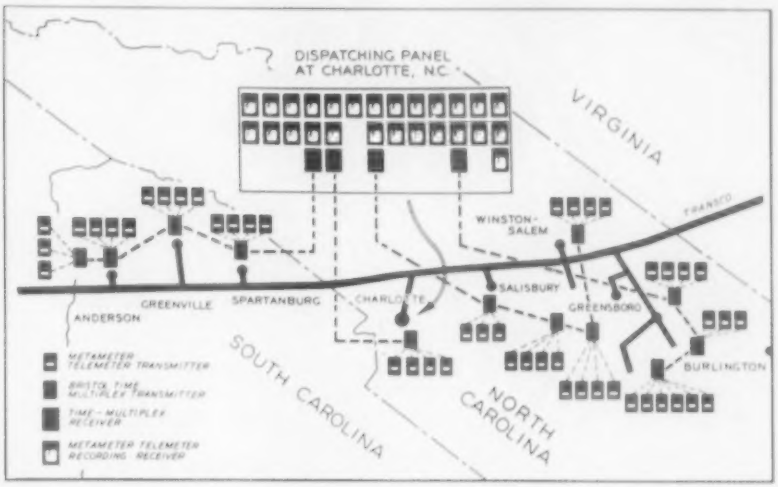
Creekmore Drilling Co., Tulsa, has a rig working for Plains Exploration Co. at a wildcat location, 1 Mackenzie, in 14-9n-57w, 5 miles north of the North Stoneham area, in Weld County, northeastern Colorado.

J. C. Trahan, Shreveport, is drilling on a 6,700-ft. Travis Peak test at the southeast edge of Spider field, in DeSoto Parish, north Louisiana. It is a contract job for Vanson Production Corp., of Dallas, at 1-A Vanson-Petty, in 10-11n-14w.

Nicklos Drilling Co., Houston, will drill Continental Oil Co.'s newest offshore wildcat test, located in Block 73, East Cameron area, in the Gulf of Mexico, off the coast of Cameron Parish, Louisiana. Location is about 2½ miles east of Continental's new gas-condensate field, in Block 71. It is about 20 miles from shore.

Circle Drilling Co., Lake Charles, La., has contracted for a 10,300-ft. Wilcox test to be drilled for C. B. Pennington, of Baton Rouge, at a wildcat location in the northern tip of East Baton Rouge Parish, southern Louisiana. The test will be carried as 1 E. E. Brown. Location, in 43-5s-2w, is about 15 miles northwest of Baton Rouge.

Moran Drilling Co., Wichita Falls, is contractor on a rank wildcat test Van-Grisso Oil Co., of Oklahoma City, is putting down in Stanton County, in far-western Kansas. Location, at 1 Wilson, in 11-27-43, is 14 miles northwest of Manter. It is 14 miles west of nearest production in Hugoton gas field, and about the same distance southwest of the one-well Helfrich field, productive of oil from Morrow sand. The Stanton wildcat will be carried to the Mississippian about 5,500 ft.



TELEMETERED signals from 46 points help Piedmont Natural Gas Co. keep a 99 per cent load factor on its pipeline system. Fig. 1.

Eight months of operation has proven

How multiplexed telemetering helps a gas pipeline system

by A. P. Hyde

LAST fall, just before the beginning of the winter heating season, Piedmont Natural Gas Co. completed installation of an extensive telemetering system. The system has resulted in more efficient, more economical, and more dependable operation.

Author is engineer with Bristol Co., Waterbury, Conn.

Piedmont takes gas from Transcontinental Gas Pipe Line Corp. and transports it to several cities in both North and South Carolina.

Besides these community loads, it has several sizable industrial loads. In addition, the pipeline transports gas to a takeoff point at Burlington, N. C. From here the Public Service Co. of North Carolina supplies service to Raleigh and Durham.

This complex system requires very close supervision in order to maintain profitable operating conditions.

To supply the dispatcher with all the necessary information on pipeline conditions, Piedmont decided to use telemetering. This required measuring temperature, pressure, and flow of the gas at a large number of outlying stations, transmitting the measurements back to the dispatching headquarters at Charlotte, N. C., and there recording the measurements for permanent reference.

After a thorough study, it was decided that measurements would be needed from 46 telemeter transmitters at outlying points in order to centralize all the information required in the immediate future. These transmitters were spotted along the entire length of the pipeline system—a distance of some 250 miles.

For reasons of service and economy, transmission circuits leased from the Southern Bell Telephone & Telegraph Co. were used between the transmitters and receivers. But 46 separate circuits would have proved far too costly. So Bristol engineers were called on to supply some method of reducing this expense.

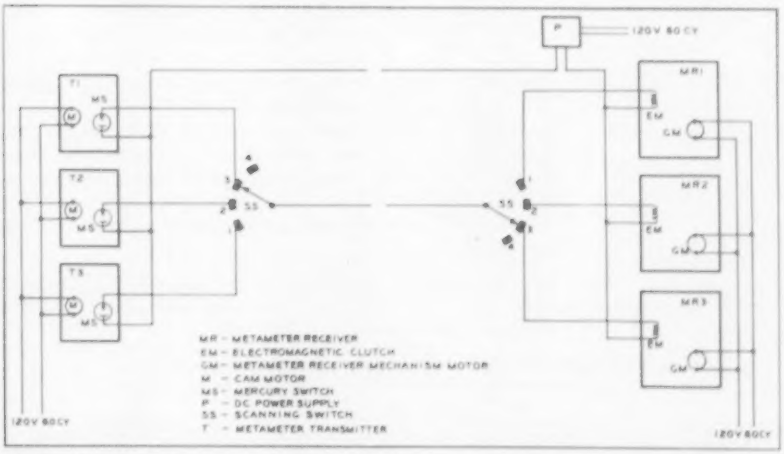
The actual installation uses the new Intermediate Time-Multiplexing equipment which permits sequential selection of the telemetering signals. With it, the entire monitoring job is handled with only four leased telephone circuits. (See Fig. 1.)

How it works . . . The Bristol Metameter telemetering system is an impulse-duration-type telemetering system. That is, the measured variable is transmitted as an electrical impulse of a definite duration.

Take a standard 5-second-cycle Metameter system, for example. If the pressure range of the instrument is 0 to 500 psi., and the actual pressure is 250 psi., the impulse will be 2½ seconds long. If the pressure is zero, the impulse will be 1 second; if it is 500 psi., the impulse will be 4 seconds long. The length of the electrical impulse is thus proportional to the measured variable.

This impulse is transmitted along a circuit of almost any type (metallic or radio) to the receiver. Here it is converted into a mechanical motion which positions the recording pen or indicating pointer to show the measured value.

The time-multiplexing equipment also consists of a transmitter and a receiver. These are shown diagramatically in Fig.



TRANSMITTER and receiver of the multiplexing system. Rotary switches connect individual function transmitters sequentially with the master receiver. Fig. 2.

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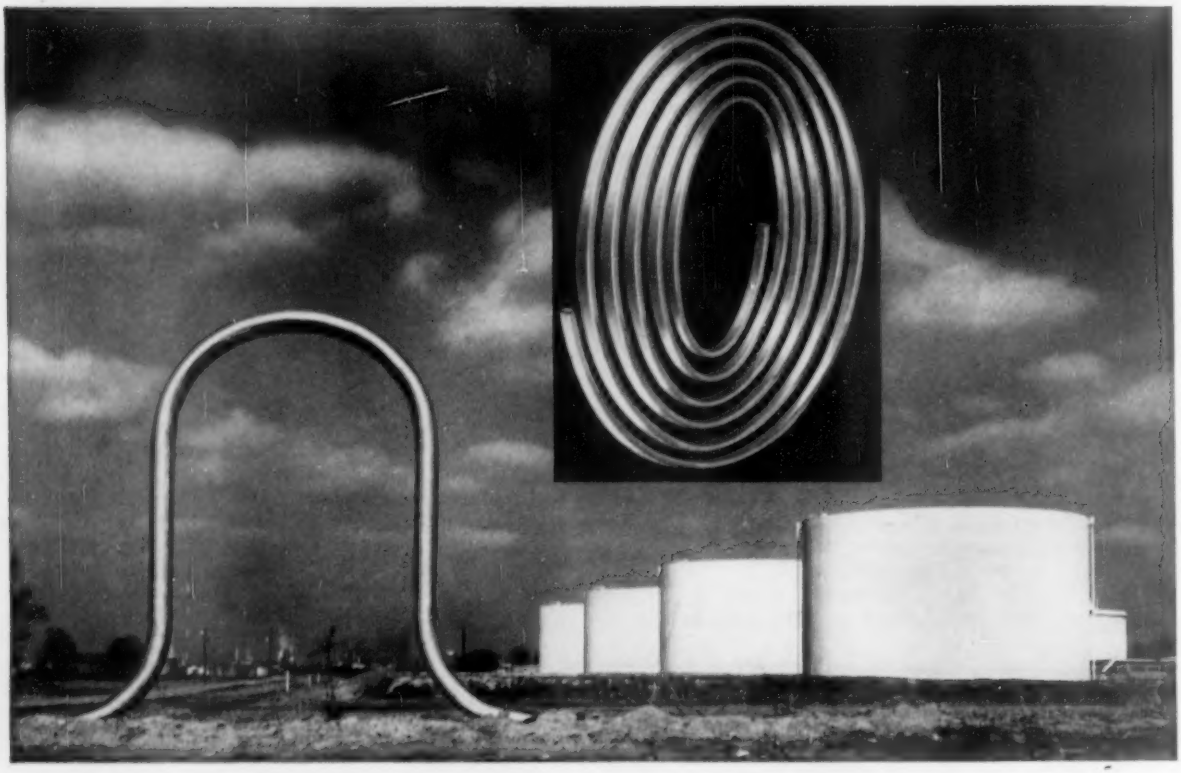

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TRANSMITTERS for flow, pressure, and temperature are grouped in this weatherproof cubicle. Fig. 3.

2. T1, T2, and T3 in Fig. 2 are all telemeter transmitters; MR1, MR2, and MR3 are recording receivers. SS on the left represents the scanning switch in the multiplex transmitter, while the SS on the right represents the scanning switch in the receiver.

As these scanning switches rotate in synchronization with each other, they sequentially connect a series of transmitters to their respective receivers. The switching mechanism dwells on each point only long enough (13.1 seconds) for the transmitter to correctly position its receiver pen.

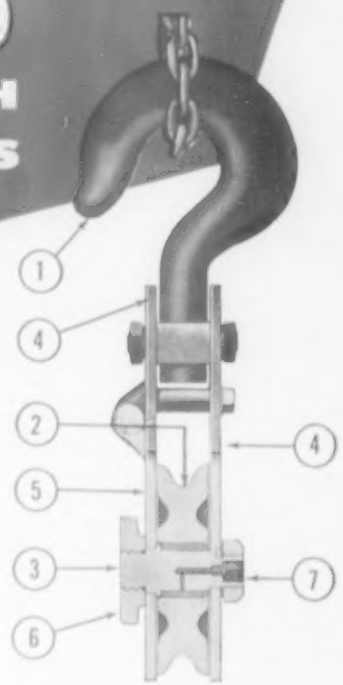
Up to 15 measurements can be multiplexed in this fashion and all variables will be measured once in 3.2 minutes. Naturally, if less than 15 transmitters are used, the cycle is correspondingly shorter. Refinements in the circuit prevent loss of synchronization and make the instrument fail-safe for power loss or other operating failures.

Multiplexing saver circuits . . . Ordinarily, all transmitters in a given area are connected to one multiplex transmitter which then sends all the measurements sequentially back to the dispatching office. There the multiplex receiver unscrambles them and directs them to their respective receivers.

However, in the Piedmont installation, the transmitter groupings did not make this feasible. Therefore, a setup with intermediate multiplexing transmitters was devised. It is shown schematically in Fig. 2.

Readings from several transmitters in one area are multiplexed and sent along a telephone circuit toward Charlotte. When they reach another area where transmitters are installed, they pass through an intermediate multiplex transmitter. This allows them to pass, but it also interjects its own multi-

THE Inside Story of WECO SNATCH BLOCKS



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DISPATCHER'S ROOM at Charlotte has recorders for all telemetered functions. Master receivers for the four channels are in lower part of panel. Fig. 4.

plexed readings of pressure, temperature, or flow. These two sets of measurements then continue on to another intermediate transmitter which adds a third set of readings, and so on.

Of the four telemetering circuits at Piedmont, three are of this type. One contains two intermediate transmitters and two others have three. This is the first installation utilizing this method of multiplexing readings to conserve transmission circuits.

A typical telemetering-transmission center is shown in Fig. 3. The four indicating instruments in the metal housing are Metameter transmitters; two measure differential pressure, one static pressure and one temperature, at the Charlotte takeoff from Transcontinental. The instrument at the far right in the picture is the multiplex transmitter.

At the Charlotte dispatching office, Multiplex receivers separate the incoming signals and send them to the proper recording receiver on the panel board. Most of these recorders are two-pen instruments for ease in record comparison, as well as economy of panel space. The panel board is shown in Fig. 4.

The installation work on this system was completed in September 1954. Plans called for operating at 99 per cent of the load factor.

The continuous supervision and complete coverage of the telemetering system has allowed continuous operation very close to this 99 per cent load factor, and the system has given completely satisfactory service.

A.S.M.E. and A.P.I. issue new pipeline codes

A REVISED Section 8 on Gas Transmission and Distribution Piping, ASA B31.1, has been released by the American Society of Mechanical Engineers. This section was prepared by a committee of recognized experts, who devoted nearly 3 years of intensive effort to this project.

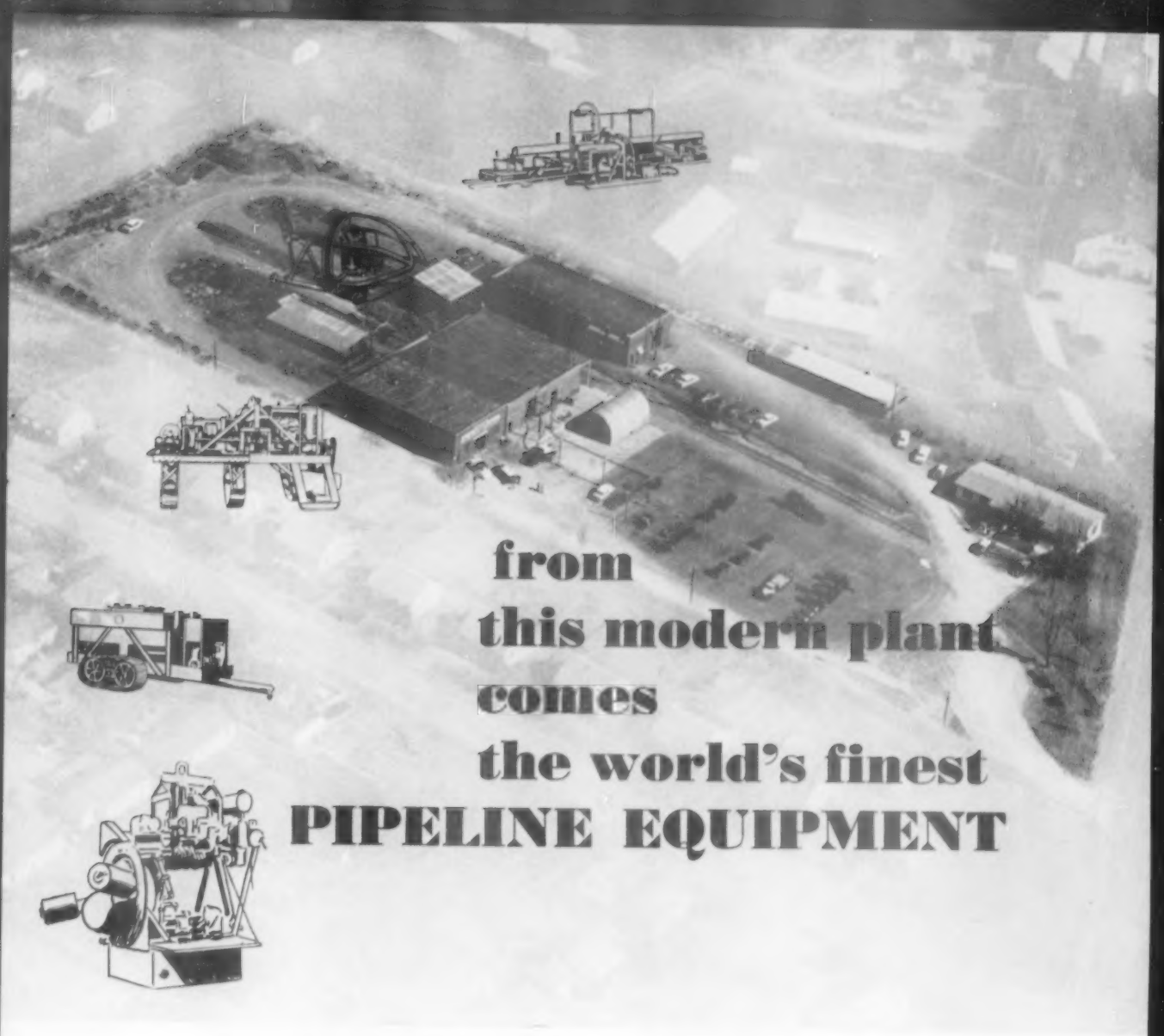
The new section of the American Standards code has been approved by the American Gas Association Board of Directors, the A.S.M.E. Board of Codes and Standards, and the American Standards Association. It establishes safe standards in the design, fabrication, and installation of gas transmission and distribution pipeline systems. It also covers the safety aspects of inspection, operation, and maintenance of gas pipelines. Gas compressor stations, gas metering and regulating stations, gas mains, and gas services, are also included.

Its requirements are deemed more than adequate for safety under all conditions normally encountered in the gas industry.

Section 8 is concerned with safety of the general public and employes to the extent that such safety is affected by basic design, quality of materials, workmanship, and requirements for testing and the maintenance of gas pipeline facilities.

New oil-pipeline bulletin . . . The division of transportation of the American Petroleum Institute has issued a bulletin on oil and products pipeline construction. Designated A.P.I. Bulletin 1105, it covers specifications and contract procedures generally applicable to pipelining.

The bulletin is divided into three parts as follows: (1) Methods of construction and reasons for certain specifications and contract clauses; (2) sample specifications; and (3) sample contract clauses.



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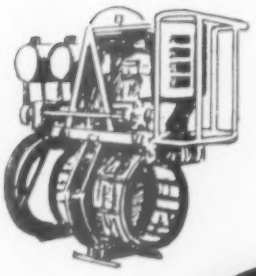

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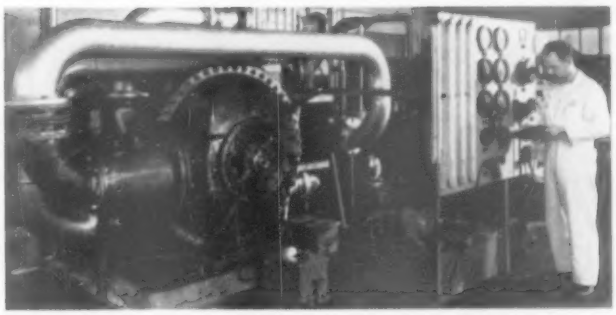
by Dan B. Miller



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Electronic Computer Solves Complex Research Problems

A high-performance, moderately-priced electronic computer capable of solving the lengthy and complex problems of research and engineering organizations, this unit incorporates an improved two-address command structure which permits greatly increased versatility. The commands provide for addition, subtraction, multiplication, and division as well as branching and other logical operations.

Standard input and output devices furnished with the computer include an electric typewriter, a photo-electric tape reader, and a mechanical tape punch. Accessory magnetic-tape units are available for additional storage or input and output purposes. As many as four magnetic-tape units may be used to store an additional 600,000 words. Auxiliary equipment is also available to permit the use of punch cards and an incremental graph plotter.

Maintenance requirements have been cut by employing etched circuits and by packaging electronic circuitry in plug-in units. The cabinet is 27 in. wide, 30 in. deep and 60 in. high. Single-phase power requirements are only 3 kva. Since the computer cabinet is mounted on casters, it can be easily relocated. *Bendix Computer Division.*

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Tubular Welding Wire Has High Deposition Rate

A new line of tubular fabricated alloy wires is designed for open-arc application through standard semiautomatic welders. This process requires no flux and offers the versatility of manual welding with the control of the full automatic. Depositing 7 to 15 lb. of hard metal an hour, this combination makes possible a welding speed two or three times that of the manual process.

Three materials are now in production: a 50 per cent high-chromium hard-facing alloy; a 20 per cent alloy

for hard-facing; and a Hadfield nickel-manganese for buildup of manganese steel parts.

Savings in labor as a result of the exceptionally high deposition rate is but one advantage offered by the new wires. Normal 10 per cent loss for stub ends, an important item with manual electrodes, is eliminated. Since they are bare, these wires are approximately 90 per cent efficient, and there is no slag removal problem. *Stoody Co.*

Check No. 3 On The Time-Saver Card

●

Automatic Seamer Ideal For Oil, Grease Canning

A new, all-purpose, low-cost automatic seamer, designated the Angelus Model 10P, will fill a multitude of

What's New... Use the handy Time-Saver Cards

needs for the canner having a large number of changeovers or short runs.

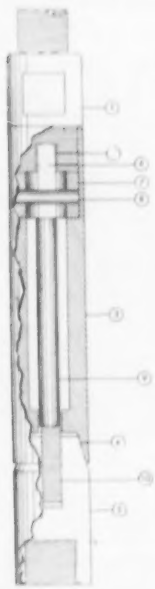
This fully automatic Model 10P seamer has a speed range of from 30 to 85 cans per minute. It will handle can diameter sizes from 2⅛ to 4¼-in. and is suitable for canning solids or liquids.

The Model 10P is a flexible machine. The small number of change parts required for can-size change help to minimize original investment in parts inventory as well as to speed up and reduce cost of changeover time. A complete line of accessories is also available for the Model 10P, including steam-injection vacuum attachments, variable-speed drives, and rotary topper. *Angelus Sanitary Can.*

Check No. 4 On The Time-Saver Card

●

Hooks Pump Tool Designed To Free Stuck Pumps



The elimination of stripping jobs, wet-string tubing jobs, stretched and damaged sucker rods, and possible injury to personnel has been achieved by installing the Hooks pump tool in the sucker-rod strings of wells that previously had been stripping jobs every time the wells were serviced.

The tool is run in the string with a pony rod between it and the pump. It becomes operative only when the service crew puts a vertical pull on the rods exceeding the normal pull necessary to unseat a pump. When the pull reaches a critical point, a shear pin (8) inside the tool shears, and allows the sucker rods to snap the body of the tool upward, striking the enclosed plunger (9) a sharp blow. This blow is transmitted to the attached pump which is usually sufficient to jar it free. Subsequent jars may be struck by alternately lowering and raising the rods.

If the pump won't jar free, the back-off feature of the tool is employed. The sucker-rod string is lowered until the pump is locked and the rod string is revolved to the right. The left-hand thread in the box (5) and mating thread (10) on the plunger is loose after the pin is sheared and the joint is easily unscrewed. The thread and all working parts are sealed from damage by corrosive fluids by their sealed-in design.

This tool is designed to be run in all tubing sizes from 2 in. up. It comes in ⅝ and ¾-in. rod sizes. *Hooks Machine Works.*

Check No. 5 On The Time-Saver Card

●

Triple Hydrometer Case Is Lightweight, Sparkproof

A new sparkproof triple hydrometer case weighs less than 1½ lb. Made entirely of welded sheet aluminum, the case is 40 per cent lighter than previous models. Hydrometers lie completely below the top edge of these cases and are protected with wool-felt lining.

The Walker safety latch, which cannot be opened accidently, is easily opened with one hand. Corrosion-resistant springs which push the latch pins home are made of stainless spring steel. Hinges are welded as an integral part of the case and will last indefinitely. *W. L. Walker Co.*

Check No. 6 On The Time-Saver Card

●

Varian Magnetometer Uses Ordinary Water

The Varian magnetometer uses the inherent properties of hydrogen nuclei, contained in any sample of tap water, to detect and measure minute changes in the earth's magnetic field and so render an improved analysis of the earth's natural resources on flights that simultaneously map the area under study.

Since the Varian instrument is calibrated on a constant of nature, the hydrogen atom's nucleus, it is independent of any outside reference point. This feature makes the new magnetometer extremely simple to build and maintain. Weight and space-saving features of the new unit are particularly important in airborne surveys. Small versions of the Varian magnetometer need weigh no more than 100 lb., excluding the primary power supply.

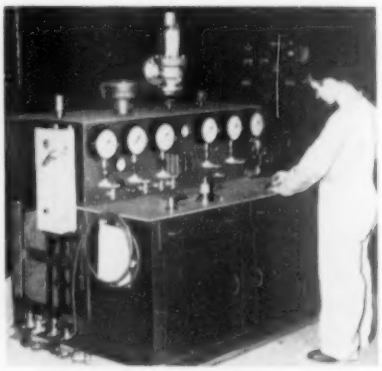
One of the most important advantages of the Varian is that it needs no gyroscopic stabilization to obtain absolute readings of total field. The "bird" that is trailed behind the survey airplane measures total magnetic field without regard to direction. *Hycon Manufacturing Co.*

Check No. 7 On The Time-Saver Card

●

Valve-Testing Unit Provides For Rapid Maintenance

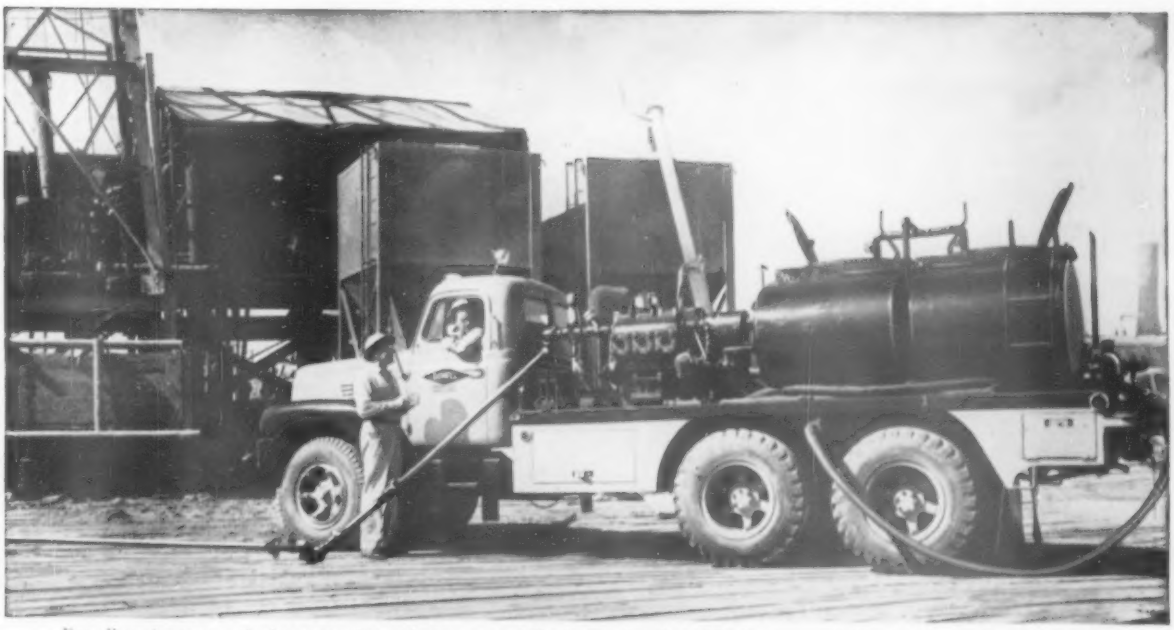
This new, semiportable, single-package-unit, all-purpose valve-testing station will test any size safety valve including an 8 by 10. All other type



valves including globe, gate, and plug cocks can also be tested by means of an integral floor manifold unit.

The new unit completely eliminates need for valve repair work by outside shops, since the test stand not only checks out new valves but also provides for rapid processing of maintenance valves.

It is mounted on a 4-in. H-beam skid for portability, providing for on-site locations where and when needed. It is ready to operate once water, air, and electrical utility lines are connected. Helium, nitrogen, and other compressed-gas testing is provided as op-



Dowell engineers use the latest treating techniques, specially designed tools and high-pressure, high-volume pumping equipment.

MUD CAKE REMOVED

Dowell Mud Acid treatment increased well potential 126 bbls. oil per day

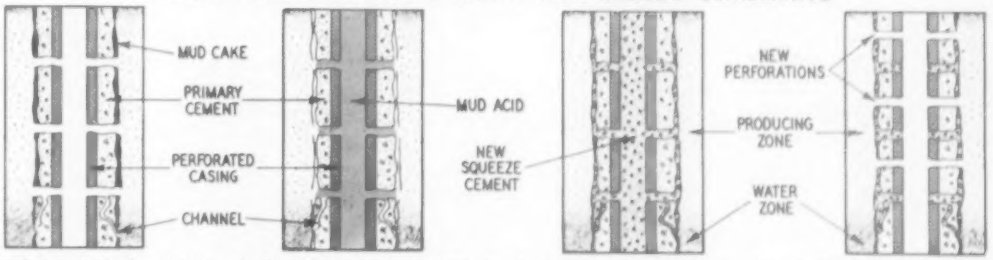
A well had shown good oil saturation, but failed to produce when completed. The operator believed that mud and mud cake on the screen, perforations and the face of the pay was restricting oil flow. Dowell engineers, called on the job, recommended Mud Acid. Following the treatment, the well's potential was 126 BOPD, flowing.

Mud Acid is a special acid solution designed to dissolve clay minerals and destroy the swelling and colloidal properties of bentonitic materials — such as found in drilling mud. It is used to restore and increase permeability of critical zone at well bore, to clean liners, screens, perforations and the formation face.

Mud Acid is also used to free stuck drill pipe; to spearhead fracture treatments; to clean gravel packs; to increase capacities; and to reduce injection pressures of gas and water input wells.

Call the nearest station today for full details on Mud Acid and the many other Dowell oil field services. Or write to DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. F-11.

HOW MUD ACID ALSO HELPS IN SQUEEZE CEMENTING



1. Incomplete removal of mud cake produced a poor cement job. This mud may break down, permitting water or gas to enter well.

2. Dowell Mud Acid (used ahead of squeeze job) removed mud cake, cleaned old cement surfaces, exposed clean formation.

3. Following Mud Acid wash, squeezed cement penetrated open spaces . . . formed a good bond with the formation and casing.

4. Here is the well after excess cement had been drilled out and casing re-perforated. In this way, producing zone was isolated.

services for the oil industry

DOWELL

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tional equipment. It is designed with proper orifice sizes, test drum, and top-quality components. Floor testing is provided for large and heavy valves.

Accessory equipment such as spools, gages, gaskets, wrenches, and lapping equipment are included. The instruction manual contains time-tested and proved test data and correction factors for resetting of valves for proper service conditions. The unit contains air tanks and compressors for pressure to 500 psi. An air-powered booster pump with a 60 to 1 ratio furnishes hydraulic pressure up to 6,000 psi. There is enough air volume from the enclosed supply tank to test all safety-valve sizes. Heavy forged C-clamps, tools, and necessary adapters are provided for mounting valves. *Farris Engineering Corp.*

Check No. 8 On The Time-Saver Card

●

New Rig Designed With Open Crown and Front

Because the crown of the Skytop drilling rig is open, the height to which pipe can be pulled above the derrick is limited only by the number of joints that will stand erect. The 60-ft. derrick, which stands pipe in 63-ft. doubles, is designed for deep workover and slim-hole drilling.

The working-hook capacity of the derrick is 150,000 lb. The draw works is of the two-speed, double-drum type. It is equipped with air clutches, torque converter, and a 300-hp. prime mover. It is recommended for slim-hole drilling with 2½-in. tubing for workovers with 2⅞-in. drill pipe to 10,000 ft. and with 3½-in. drill pipe to 5,000 ft.

The derrick's restricted height and one-fold design holds weight to a minimum. Self-supporting load balance eliminates need for guy wires. With related equipment properly unitized, the rig can be dismantled, moved, and rigged up in 6 hours.

The derrick, draw works, substructure, light plant, and hydraulic-tong unit, mounted on a 32-ft.-tandem trailer, weighs less than 60,000 lb. The derrick is made of tubular steel legs and diagonal braces, and channel-type C-braces. The front of the derrick is open throughout its length. *Skytop Rig Co.*

Check No. 9 On The Time-Saver Card

●

Pipeline Slide Rule Finds Capacities and Pressures

A newly developed hydraulic slide rule can be used as a satisfactory and conservative means of calculating capacities and pressures of products pipelines. The rule will enable any person who is familiar with slide-rule operations to determine, within the accuracy of a 10-in. rule, the rate of flow, pressure, diameter, or friction factor of the Williams and Hazen formula.

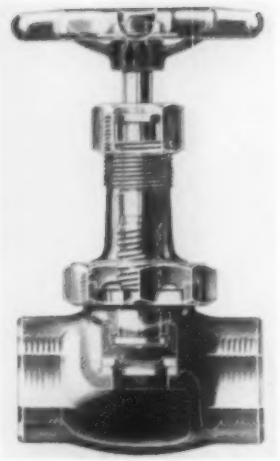
The rule is accurately marked to within 2 m. of exactness calculated in the formula using seven-place logarithm tables. Based on the Williams and Hazen formula for water flow, the rule scaling has been adapted for the specific gravity of gasoline. The rule has, incorporated into it, a viscosity factor wherein the friction factor can be changed to correspond to the kinematic viscosity of the product being pumped. A complete and informative manual, covering use and providing a comprehensive reference, accompanies the rule. *Frank E. Richardson.*

Check No. 10 On The Time-Saver Card

●

Bronze Globe Valves Last Longer in Severe Service

A new bronze globe valve, the LQ600, has been tested by many leading companies on difficult problem installations. In many of these services,



other valves lasted only 3 to 4 months on the average. But during the entire 4-year testing program, the LQ600 valve has never failed or leaked.

This performance record is made possible by a combination of two new elements. The first is a new patented seating metal, Brinalloy. This second element is the flat-seat design of the valve. *The Lunkenheimer Co.*

Check No. 11 On The Time-Saver Card

●

Variable Speed Transmission Featured in Ditch-Witch

Model LD Ditch-Witch trencher features a variable-speed transmission and completely new design. Capable of various speeds while digging, this self-contained unit is ideal for any number of light trenching jobs and is specially recommended for trenching for both small-diameter pipe and cable, shallow footings, and many other applications. Controls are located for operating the trencher from the seat or while standing beside the machine. All drives are safely covered yet easily accessible.

The standard 6-in.-width bucket line is hydraulically controlled to a depth of 36 in. The bucket line is closed, self-cleaning, and has replaceable tool-steel teeth. *The Charles Machine Works.*

Check No. 12 On The Time-Saver Card

They're NEW

- Bulletins
- Catalogs
- Brochures

for your copy, check ✓ ✓ the Time-Saver Cards.

Multiple Pressure Readout Systems. Multiple pressure readout systems to speed up data handling for process industries are illustrated in color in a new 12-page catalog 58-15. These packaged systems utilize a single high-accuracy sensing device and pressure comparators to sample up to 200 pressures simultaneously with accuracy of 1 part to 2,000. Operation, applications, and performance characteristics are illustrated with photos, dimension drawings, and schematic diagrams. *Fischer & Porter Co.*

Check No. 13 On The Time-Saver Card

●

"How to Solve Piping Flexibility Problems" is the title of a new eight-page bulletin No. 28. One section shows swing joints and flexible ball joints as used in tank-truck loading and unloading lines. For the refinery experiencing difficulty in handling hot asphalt, the bulletin shows several ways to solve the problem. Details are also being given on steam-jacket ball joints. Detailed information on simplified switching of permanent piping lines is included, plus a section on how to protect lines against shock, tank settling, and thermal movement. *Barco Manufacturing Co.*

Check No. 14 On The Time-Saver Card

●

New Liquid-Level Bulletin. A new 26-page bulletin describes a complete line of liquid-level gages for indicating, recording, controlling, and telemetering. The well-illustrated, two-color bulletin shows float type, pressure type, differential-pressure type, and bubble-type liquid and water-level gages, in strip and round-chart models. Air or electric controllers are available in several models. A new weatherproof case is shown for the 8 and 12-in. round-chart recorders and controllers. *The Bristol Co.*

Check No. 15 On The Time-Saver Card

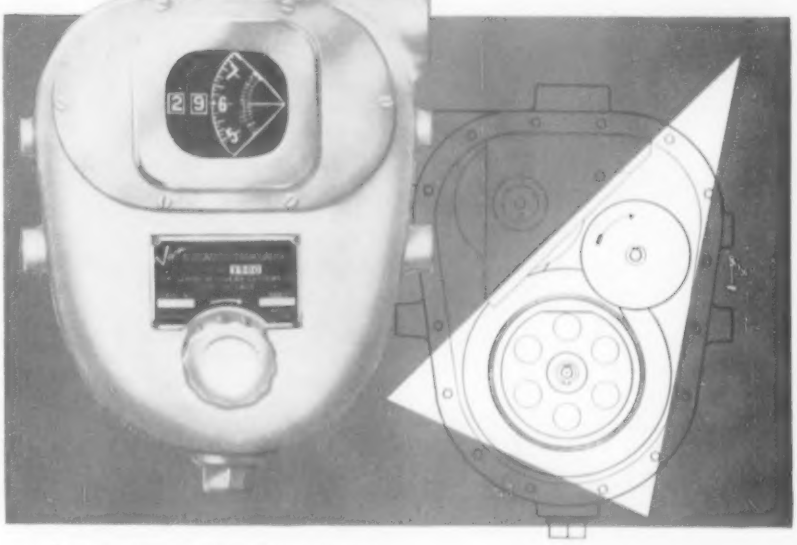
●

Steel Pipes for the Petroleum Industry, a six-page foldout, illustrates nonupset and internal-upset casing, nonupset and

"Varec" FIG. NO. 2500 SERIES

AUTOMATIC TANK GAUGES

PIONEERED, DEVELOPED AND MANUFACTURED IN RESPONSE TO INDUSTRY DEMAND



Positive, convenient, mechanical counter reading combined with dependable accuracy—no smudgy, graduated tape to read through a cloudy glass.

The VAREC Figure No. 2500 Series Gauges have been developed, over a period of several years, in response to urgent field requests for a dependable automatic tank gauge which would eliminate difficulties universally encountered with tape reading, counterweight type gauges. The instrument now offered represents the results of sincere effort on the part of VAREC engineers, invaluable and deeply appreciated customer-cooperation, and experience gained from over 2000 installations covering practically every conceivable field operating condition.

Successfully incorporated in this gauge are such features as (1) liquid level indication on a mechanical counter arrangement for ease of reading, (2) operation checker, (3) gravity compensator, (4) simple calibration and gravity compensator adjustment from outside the gaugehead. Never necessary to gain access to tape, loosen support brackets or make adjustments in the presence of dangerous tank vapors, (5) provision for convenient addition, at any time, of auxiliary equipment such as mechanical limit or control switches, programmers, VAREC Remote Reading Gauger Transmitters, etc., (6) corrosion resistant materials of construction, as typified by the use of specially made Type 316 stainless steel ball bearings, and (7) all metal construction of components which insures electrical ground to tank shell.

The VAREC Figure No. 2500 Series Tank Gauges are now available for higher pressures (up to 300 P.S.I. working pressure) and, as is the case with the low pressure model, a combination of sound design, quality materials, and rugged construction is offered – not construction which meets only minimum requirements at a price.

Investigate before investing. Cheaper equipment is not always the least expensive equipment.

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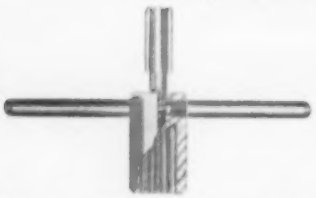

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external-upset tubing, internal and external-upset drill pipe, high-test line pipe, integral-joint casing, and shot-hole casing. *F. B. T. LeComptoir Franco-Belge d'Exportation des Tubes d'Acier.*

Check No. 16 On The Time-Saver Card

●

Mechanical and Hydraulic-Liner Hanger. A mechanical liner-hanger for plain and prepacked liners and combination cement jobs is described in a data sheet, and a one-trip combination hydraulic-liner hanger, lead seal, and port collar are illustrated in a four-page folder. Tools are further described in annotated cutaway diagrams. Action is shown in a series of sequence pictures. *J. B. Nelson.*

Check No. 17 On The Time-Saver Card

●

EBKO Piping Systems. Line drawings clearly show the assembly, consisting of the inner-pipe, molded-type insulation, inner-pipe supports, and the outer casing of these prefabricated, insulated systems for underground or overhead installations. The general design is such that the entire system, the inner piping as well as the outer casing, can be tested by visual and mechanical means before the system is placed in operation. *E. B. Kaiser Co.*

Check No. 18 On The Time-Saver Card

●

Thermon, a new heat-transfer medium, can eliminate need for jacketed equipment in many installations. Thermon is a nonmetallic plastic compound with highly efficient heat-transfer properties. It is applied in a viscous paste from either steam-traced or thermal-electric systems. The product works equally well for either heating or cooling systems. *Thermon Manufacturing Co.*

Check No. 19 On The Time-Saver Card

●

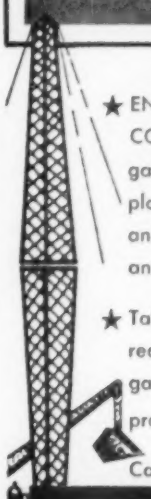
Another Tough Pipeline Job. This is the story of the 475-mile Oklahoma Mississippi River products line, originating in Duncan, Okla., and terminating at West Memphis, Ark. The four-page brochure gives particular emphasis to the 34,000 tons of 12¾-in.-o.d. National seamless steel pipe used in the construction of the line. *National Tube Division, U.S. Steel Corp.*

Check No. 20 On The Time-Saver Card

●

Ammonia Synthesis. How high yields, low operating costs, and flexibility of plant design can be obtained in the production of synthetic ammonia is the subject of a new 12-page booklet just published. The booklet describes the

Technically **TOPS**



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four basic plant types offered for the generation of synthesis gas tailored to suit local conditions and types of feed materials. The booklet details purification methods and the Kellogg process conversion employed in conjunction with: (1) Steam methane reforming under pressure using natural refinery gases of low H_2 content and coke oven gases; (2) catalytic partial oxidation using gaseous-hydrocarbon feed materials and oxygen-enriched air; (3) noncatalytic partial oxidation using natural gases or residual fuel oils; and (4) low-temperature raw-gas conversion, employing high-H_2-content feed gases without reforming or partial oxidation. Flow diagrams illustrate each basic type. *M. W. Kellogg Co.*

Check No. 21 On The Time-Saver Card

•

GMXD Compressor Bulletin. A new 24-page engineering bulletin, No. 76, describes the latest V-angle engine-driven compressor in the line. The compressor, Model GMXD, is the type widely used in field gathering operations, in refineries, and petrochemical operations. The bulletin provides technical data on the latest developments in compressor design for further improving fuel economy and increasing capacity and range of operation. *Cooper-Bessemer Corp.*

Check No. 22 On The Time-Saver Card

•

Controlled Volume Pumps in Water Treating. Prepared with the assistance of leading water-treating consulting firms, this new Bulletin 953 describes and illustrates how controlled-volume pumps are used in typical industrial water-treating systems. Typical water-treating processes described include coagulation systems, lime-soda softening, hot process softeners, demineralization, and various types of boiler water-treatment systems. Thorough analysis is given to cooling-tower water-treating problems. *Milton Roy Co.*

Check No. 23 On The Time-Saver Card

•

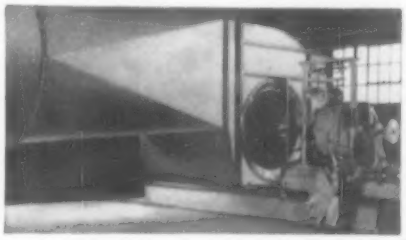
Schutte & Koerting Valves. New Bulletin V-1 is designed to show engineers, in the briefest possible way, some of the current valve types manufactured by Schutte & Koerting. The bulletin illustrates and describes a line of bleeder check, boiler feed water, venturi reducing, heater bypass, balanced butterfly, and atmosphere relief valves, plus a new high pressure strainer. It includes information on designs and specific data on construction and application. *Schutte & Koerting Co.*

Check No. 24 On The Time-Saver Card

Testing fan wheel performance in the "Buffalo" Laboratory

WHY "BUFFALO" FANS PERFORM* AS SPECIFIED

What will this wheel design deliver at various static pressures? What are the horsepower requirements? Noise level? And what's the best housing? Endless testing like this in the "Buffalo" Laboratory — plus endless designing and redesigning — brought you the famous high-performance Type BL Limit-Load Ventilating Fan — and will continue to bring you the latest and finest in fans. You can expect this inbuilt performance whenever you order a "Buffalo" Centrifugal, axial flow or propeller fan.



ALL TESTS in the complete "Buffalo" laboratory are conducted in strict accordance with the test code adopted jointly by NAFM and ASHRAE.

WHERE WE TRY TO DESTROY WHEELS — the "Buffalo" vacuum test pit where wheels are revolved at many times their operating speeds to discover — and correct — any point of structural weakness. Further assurance of a better fan buy when you specify "Buffalo".

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1954

Record Sales Year for The British Petroleum Company Limited

British Petroleum's sales of crude oil and refined products in 1954 were at an all-time high of 820,000 barrels a day, a gain of 10.5 per cent over 1953, and 20,000 barrels a day more than in the previous peak period of 1950, the last year in which the company had full production in Iran. Notable developments in the past year include the commissioning last July of a new 120,000 barrel-a-day refinery at Aden on the Red Sea and the resumption of Iranian oil operations in October by agreement between Iran and a consortium in which BP has a forty per cent interest. In February this year a 60,000 barrel-a-day refinery was commissioned at Kwinana in Western Australia. This addition of refining capacity East of Suez has greatly improved operating efficiency, eliminating the abnormally long back haul from European refineries of the past two years. With the addition of Kwinana refinery, together with expected increases in existing facilities, total refining capacity at the end of 1955 will be more than 600,000 barrels daily.

Copies of the Annual Report and Accounts may be obtained from the Company's Purchasing Agent in U. S. A., Mr. J. E. Anderson, 610 Fifth Avenue, New York 20, N. Y.

Crude Production

British Petroleum's crude oil production in the Middle East was again increased in 1954 when its daily offtake from Kuwait, Iraq and Qatar rose to 720,000 barrels compared with 640,000 barrels in 1953. Kuwait, in which BP has a 50 per cent interest, again was the major source of supply, providing 530,000 barrels daily against 470,000. Production at Kuwait has been further increased this year, a record rate of over 1,160,000 barrels daily having been achieved in the week ended February 4 last. The company's current liftings from Iran are at the rate of 100,000 barrels a day, including 40,000 barrels of crude oil.

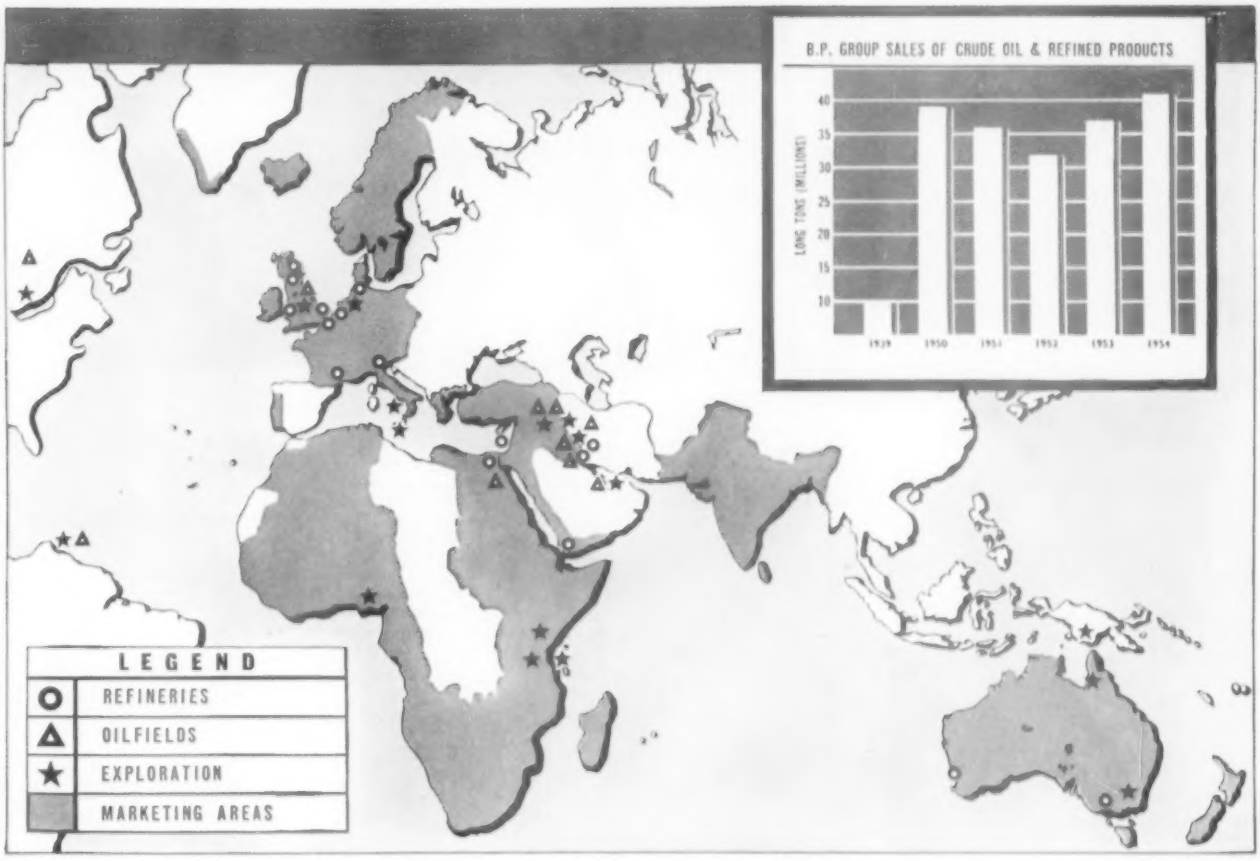
Refining

Total throughput at BP's 14 refineries during 1954 was 480,000 barrels daily, up

THE BRITISH PETROLEUM COMPANY

(NAME CHANGED FROM ANGLO-IRANIAN OIL COMPANY, LTD.)

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON · E.C. 2



80,000 barrels over 1953. Principal contributors to this gain were the Aden, Kent and Hamburg refineries. In Iran throughput at Abadan refinery is now 150,000 barrels a day. Plans are underway to increase substantially the output of petro-chemicals from a plant in Scotland and a new English company has been formed with a subsidiary of Standard Oil Company of California to produce and market intermediates used in the manufacture of synthetic detergents.

Exploration

The search for oil was increased during the year in the various overseas territories in which the company has interests, including Canada, Trinidad, Australia, Papua, Britain, East and West Africa, Sicily, Malta and the Persian Gulf. In Canada BP is in process of increasing its interest in Triad Oil Company to 50 per cent, bringing the investment in this company to nearly $20,000,000. Triad holds interests in oil reservations and leases of more than 2,000,000 acres in Western Canada. In Trinidad an associate company is developing production from a marine area and production tests are being carried out in a deep off-shore test well in the Gulf of Paria.

Tankers

British Petroleum's tanker fleet now totals 148 ships of 2,063,000 deadweight tons, compared with 142 ships of 1,917,000 deadweight tons a year ago. Modern port facilities at the new Kent, Aden and Kwinana refineries enable BP to make greater use of its increasing number of large tankers. Nine ships totalling 256,000 deadweight tons, including seven of 32,000 tons, are now under construction or on order. In addition, some 2,000,000 deadweight tons of tanker shipping continues on charter.

(Barrel figures used are approximate)

LIMITED

FINANCIAL HIGHLIGHTS

	1954	1953
Gross Consolidated Profit	£75,348,941	£63,883,828
Depreciation	£30,406,091	£20,056,243
Profit Before United Kingdom Taxation	£43,942,850	£42,931,666
Net Profit to BP	£23,962,764	£24,382,850
Dividends	£16,174,359*	£ 9,629,672

* Including recommended final dividend

EQUIPMENT MEN . . . in the News

A-C Assigns Four to District Office Posts

David L. McCausey, Jr., Thomas E. Blackwelder, and Robert D. James have been assigned as sales representatives to the Tulsa, Okla., Jacksonville, Fla., and New Orleans, La., offices respectively of Allis-Chalmers general machinery division.

In addition, Gene Melton was appointed field serviceman in the company's Midwest region with headquarters in St. Louis.

All of these men recently completed the Allis-Chalmers training course for graduate engineers.

Axelson Appoints New General Sales Manager

E. D. JACKSON

Edward D. Jackson has been appointed general sales manager of Axelson Manufacturing Co., division of U.S. Industries, Inc. His appointment was announced by W. W. Greenway, vice president of U.S. Industries and general manager of Axelson.

Jackson will direct national and international sales operations for all Axelson manufactured products. He will make his headquarters at Axelson's main office in Los Angeles.

Prior to joining Axelson, Jackson was associated with Toledo Scale Co. as vice president in charge of sales. Prior to that he was national sales manager for the Coroaire Heater Corp. and Hot Boy, Inc., of Cleveland, Ohio. He has also held executive positions with the Marquette Metal Products Co. and the Acrotorque Co.

Baash-Ross Names Bronzan Assistant General Manager

B. BRONZAN

The appointment of B. Bronzan as assistant general manager for the Baash-Ross operations has been announced by Glenn Johnson, general manager of the Baash-Ross Tool Co., a division of the Joy Manufacturing Co. Bronzan is well known throughout the oil industry, both for his knowledge of field methods and for his administrative abilities.

Bronzan's background in precision manufacturing operations as well as his knowledge of oil tool operations make him an ideal selection to assist Johnson in administration of the activities of the Baash-Ross organization.

Waukesha Sales, Service Holds Annual Sales Meeting

Waukesha Sales & Service, Inc., recently held its annual sales meeting at Houston. L. M. Pearce, Jr., president of Waukesha Sales & Service, conducted the meetings. Representatives from the Houston headquarters and branches in Texas, Louisiana, and New Mexico attending were: G. A. Duncan; H. R. Wilson; E. R. Rutenber, chief engineer; and F. C. Schluze, sales manager—all with Waukesha Motor Co. And L. M. Pearce, Jr., president; C. O. Zagst, sales manager; W. A. Sahlen, comptroller; J. L. Kluppel, service manager; W. J. Buehring, service parts manager; J. W. Ramsey; Ralph Wallace; Bill Ball; Monte Whitten; J. S. Warnick; F. A. Chance; L. B. Taylor; Mrs. Dorothy Wilbanks; J. T. Wilchek; W. O. Nugent; W. L. Jenkins; J. B. Krenek; F. M. McCarthy; R. L. Bouchard; Harold Sherrod; L. D. Harbour; J. B. Patterson; W. W. Stewart, Jr.; Dale Bond; T. B. Gatewood; Leon Miller; E. D. Kelly; G. E. Swann; S. W. Wacey; G. C. Shows, Jr.; F. L. Williams; Cecil Hobdy; J. C. Wo'fe; W. T. Crawley; I. J. Slay; and A. C. Webb

McLaughlin Joins Cardwell To Head Research Group

McLAUGHLIN

The appointment of Philip L. McLaughlin to head the new product and drilling research department, has been announced by H. W. Cardwell, president of Cardwell Manufacturing Co., Inc., Wichita. McLaughlin, known for his writing and editorial coverage of new and improved drilling techniques, will be in charge of product and drilling research in addition to advertising and sales promotion. His past engineering experience has been with Continental Oil Co. at Hobbs, N. M.; the Ohio Oil Co. at Iraan, Tex.; in the Midland district office, Midland, Tex.; and in the Houston division office prior to joining World Oil in 1952.

McLaughlin's responsibilities will be world-wide in scope. He will coordinate product and drilling research with Cardwell's direct sales organization and the New York export division.

Electro-Technical Adds Hall to Executive Staff

Ernest M. Hall, Jr., has been named executive vice president of Electro - Technical Laboratories, Inc., Houston. In his new post he will handle sales and engineering activities of the company. Hall was formerly connected with Associated Instruments, Houston.

Martin-Decker Officers Travel to Foreign Fields

E. L. DECKER

E. L. Decker, president of the Martin - Decker Corp., Long Beach, Calif., has left California to attend the International Petroleum Congress in Rome. He will spend about 2 months making business stops in Italy, Sicily, Spain, France, Germany, and England.

Louis Q. Webber, plant manager of Martin-Decker, is on a trip through the Middle East where he is visiting the active drilling areas in Saudi Arabia, Kuwait, Qatar, Iraq, and Egypt. He will probably return by way of Europe sometime in July.

Pearson Named Field Sales Manager for Enterprise

R. M. PEARSON

The appointment of Robert M. Pearson as field sales manager of the Enterprise Engine & Machinery Co., San Francisco—a division of General Metals Corp.—has been announced by Arthur W. Ostrander, general sales manager of that firm.

Pearson has been active in the diesel-engine industry for 30 years, the past 12 with National Supply Co. as manager of sales. He was previously with Fairbanks, Morse & Co. and General Motors Corp.

Otis Assigns Green, Horton To New Posts at Houston

Otis Pressure Control, Inc., has announced the appointment of R. L. (Bob) Green as superintendent of its Houston division and Harold Horton as a service specialist.

R. L. GREEN

H. HORTON

Green, formerly a service specialist in the Houston branch, joined Otis in September 1944. He has worked as a sales engineer for Otis in Hobbs, as division superintendent at Odessa, and as a wire-line specialist in Elk City. He was employed by Gulf Oil Corp. before joining Otis.

Horton will continue to work out of the Houston division. With the company for 9 years, he formerly was a wire-line specialist in the Houston branch. Prior to joining Otis he was with the Parkersburg Rig & Reel Co.

Oilwell Announces Field Staff Appointments

The appointments of Jack M. Lucey as area manager, production equipment sales, of the Rocky Mountain area; John M. Rohrig as field representative at Huntington Beach, Calif.; and Ivan R. Blauser, Jr., as assistant district engineer at Parkersburg, W. Va.; and the transfer of Elmer E. Stanley, field representative from Duncan, Okla., to Healdton, Okla., have been announced by U.S. Steel's Oilwell Supply Division.

Lucey was hired by Oilwell in 1949 as an engineer trainee at Casper. In 1950 he was appointed assistant district engineer. He became district engineer at Casper 2 years later and has served in this capacity until his present appointment.

Rohrig was employed by Oilwell in 1949 at Huntington Beach. Prior to his present appointment he served as pump repairman at that location.

Blauser was employed by Oilwell in 1953 at Mount Carmel, Ill., as an engineer trainee. In 1954 he was appointed district representative at Carmi, Ill., the position he held until his present appointment.

Stanley joined Oilwell in 1953 as a storeman at the Duncan store. He became field representative at that location in 1954.

Pioneer Specialties Names Five New Representatives

Five new representatives have been named by Pioneer Specialties, Inc., in the West, Southwest, Midwest, and in the North Central states.

In California, George Kerbo, Long Beach, and L. O. Montgomery, Bakers-

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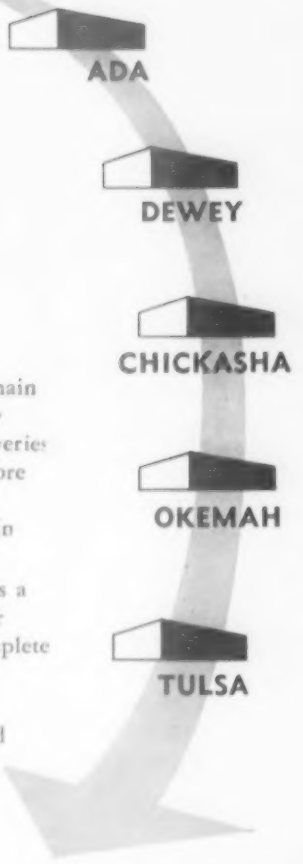
. . . IN OKLAHOMA

Need service fast? With five main outlets in Oklahoma, Dewey Supply Company can now offer fast deliveries around the clock. Just pick the store most conveniently located to your operation, or call the main office in Tulsa for complete information.

Dewey Supply Company handles a full line of equipment for all major oil operations, and will offer a complete credit plan to meet the needs of each individual buyer.

Remember, for fast delivery and excellent service, you can depend on Dewey Supply.



DEWEY SUPPLY COMPANY

208 CONSTANTINE BUILDING
TULSA, OKLA.

field, have been appointed joint agents.

Southern Oklahoma has been added to Pioneer Specialties' territory with Lee Franks, Wichita Falls, Tex., as representative. Franks has represented Pioneer in North Texas for some time.

The Kansas and northern Oklahoma area is now represented by W. W. (Woody) Coonrod with headquarters and warehouse stock at Great Bend, Kans.

James O. Gravitt, Mount Vernon, Ill., will handle sales and service in the North Central states. Field emergency stocks will be warehoused at Mount Vernon.

Warehouse stocks will be maintained in Long Beach, Ventura, and Bakersfield. They will supplement supply store stocks. A company warehouse for Pioneer stocks has been established at Lindsay, Okla., to service the new area. This is in addition to the warehouse at Wichita Falls.

Broderick & Bascom Elects New Officers

At the annual meeting of the board of directors of Broderick & Bascom Rope Co., Joseph H. Bascom, executive vice president and treasurer, was elected president of the firm. C. E. Bascom, retiring president, was elected chairman of the board of directors. A. A. Grosse, secretary and assistant treasurer, was made secretary and treasurer.

At the meeting of stockholders held the same day, Stanley R. Brenner, vice president, operations, was elected to the board of directors.

Broderick & Bascom officials who will continue in their present positions are: Fred Zimmerman, vice president, sales; J. J. Sieber, sales manager; Raymond Knefel, controller, and George T. Born, assistant secretary.

American Announces Several Transfers and Additions

E. B. BURSON

E. M. SLETTE

American Iron & Machine Works Co., Inc., of Oklahoma City has announced the following recent additions and transfers in its field sales force.

New sales personnel include: E. B. Burson, who will cover the territory

H. CLINGAN

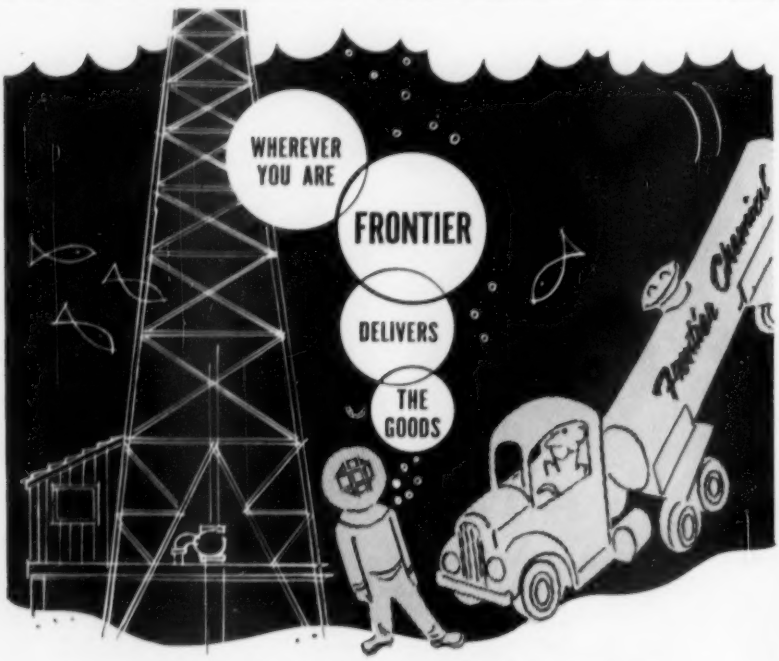
C. G. GILSTRAP

of Southeast Louisiana; E. M. Slette, who will travel the Southwest Louisiana area; Harold Clingan, who will cover the New Mexico territory; and C. G. Gilstrap, who will represent the company in the West Texas area.

H. H. FULLER

P. L. GILLIS

Transfers of American personnel include the following: H. H. (Jack) Fuller, who will cover West Texas in a sales capacity; and P. L. Gillis, who



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Frontier Chemical Company

DIVISION OF UNION CHEMICAL & MATERIALS CORP.

GENERAL OFFICES
WICHITA, KANSAS

WICHITA, KANSAS / DENVER CITY, TEXAS / DUMAS, TEXAS / MIDLAND, TEXAS

has recently been transferred from Houma, La., to the Kansas sales area.

Burson was formerly in sales with Reed Roller Bit and McCullough Tool Co. His headquarters will be in Houma, La. Formerly in sales work with National Supply, Clingan's headquarters will be in Hobbs, N. M. Gilstrap will make his home in Midland, Tex. Fuller was formerly sales representative for American Iron in the New Mexico territory. He will live in Odessa, Tex. Gillis will make his headquarters in Great Bend.

Union Wire Rope Opens Birmingham Warehouse

JIM LESTER

With the opening of a new warehouse in Birmingham, Ala., Union Wire Rope Corp. has eight branches strategically located across the South from Odessa, Tex., to Jacksonville, Fla., District manager Jim Lester, who began in the Union Rope factory in 1943, will manage the Birmingham operation. Since 1948, he has headquartered at the Oklahoma City branch and represented the corporation in Oklahoma and the Texas Panhandle.

W. H. WALL

DON MUNSELL

W. H. Wall, who, since 1953, has been traveling the Kentucky, Virginia, and West Virginia territory of the Ashland, Ky., branch, has been transferred to Durham, N. C., where he will cover the states of Virginia and North Carolina.

Don Munsell, who has been working out of the Jacksonville, Fla., branch under the direction of division manager George Golay has been assigned to territory comprising the State of South Carolina, the eastern half of Georgia, and Florida, except Pensacola.

Dowell Promotes Hefley to Assistant General Manager

Dowell Incorporated has promoted Dana G. Hefley to assistant to the general manager in Dowell's general offices in Tulsa. A. C. Polk, vice president and general manager, made the announcement. Hefley formerly headed Dowell's technical development department.

"Hefley will assist the general manager in the control and administration of specific broad management functions," Polk said. The technical development department which Hefley headed will be combined with the field development department, headed by J. Keller Henderson. All functions and personnel of the technical development department will be transferred to field development.

Hefley joined Dowell in June, 1953, as a research chemist. Subsequent promotions were: research engineer, assistant research director; chief research engineer, and technical development manager. Before joining Dowell, he worked 1 year for the Marland Oil Co. and 6 years for the Indian Territory Illuminating Oil Co.

Stewart Made Assistant to Mission's Sales Manager

J. S. (Jack) Stewart has been appointed assistant domestic sales manager of Mission Manufacturing Co. Stewart has been with Mission Manufacturing 14 years, during which time he has worked in field engineering and sales division.

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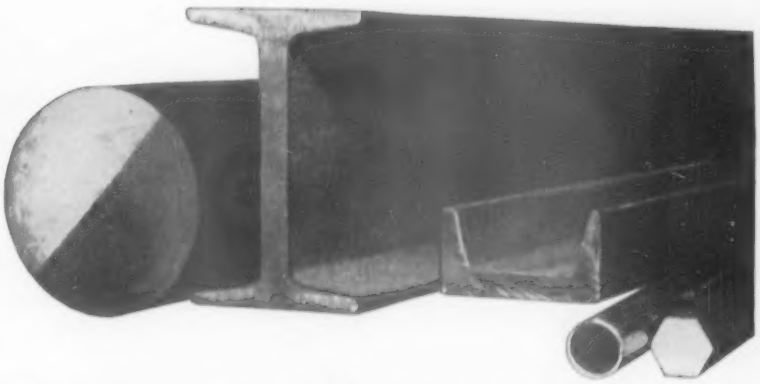

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New Pay Zone for Southern Oklahoma

by Norman S. Morrisey

POROUS dolomites in the Arbuckle limestone in southern Oklahoma are untested but potential pay zones.

Until recently, the Simpson sands were the deepest pay horizons for the area. Wells that tested dry in the lowermost Simpson sand (the basal Oil Creek) were either completed up the hole or abandoned. Occasionally an operator would drill several hundred feet into the Arbuckle limestone, but the results were discouraging and the hole was plugged.

Almost overnight, however, the role of the Arbuckle in exploration thinking has changed completely. Frankfort Oil Co. 2 Williams (12-5s-2w) recovered 4,938 ft. of free oil on a 9-hour drill-stem test of the Arbuckle interval 12,390-12,435 ft. And this zone was 4,500 ft. below the top of the Arbuckle.

On the strength of this test, geologists are taking another look at the Arbuckle in southern Oklahoma. It looks very promising as a potential reservoir because:

1. Three thick, porous, dolomite units are present on the known outcrops in the Arbuckle Mountains.

2. At least one of these units, the Royer dolomite, enjoys widespread distribution over most of southern Oklahoma.

3. In Grayson County, Texas, the Ellenburger (the Arbuckle equivalent) is an important producing zone, only 20 miles from the 2 Williams.

Well control sparse . . . Actually, the Arbuckle limestone in southern Oklahoma is an unknown quantity. Few if any wells have ever drilled a complete section of this 6,000-ft. limestone and dolomite section. The handful that have were very poorly located and were not designed to test the entire Arbuckle possibilities adequately. Most Arbuckle wells tested only the upper few hundred feet because operators were looking for production at an unconformity surface. The famous Oklahoma City field has such Arbuckle production, and many fields in Kansas produce from an eroded Arbuckle surface.

		FORMATION	REMARKS
ORDOVICIAN	ARBUCKLE GROUP	West Spring Creek 1,400 ft.	Dolomite zone in upper part, 300-700' thick in Arbuckle Mountains
		Kindblade 1,500 ft.	
		Cool Creek 1,200 ft.	Oolitic chert common
		McKenzie Hill 900 ft.	
UPPER CAMBRIAN		Butterly 300-700 ft.	Well-developed dolomite zone in Arbuckle Mountain outcrops
		Signal Mountain 1,600 ft.	
		Royer 300-700 ft.	Persistent dolomite unit in southern Oklahoma
		Fort Sill 500-1,200 ft.	
	Timbered Hills Group	Honey Creek 200 ft.	Glauconitic limestone
		Reagan 500-1,000 ft.	Locally glauconitic sandstone

Thick porous dolomite zones in the Arbuckle group make an attractive target for the bit.

But detailed surface geology, rather than subsurface data, provides the best answer to possible Arbuckle pay zones. The Arbuckle is exposed in the mountains north of Ardmore, Okla., and the outcrop covers about 375 sq. miles. Similar outcrops are present in the Wichita Mountains 100 miles to the northwest. Three dolomite zones in the Arbuckle Mountains outcrop appear to be of regional significance and each of these zones ranges from 300 to 700 ft. thick, according to William E. Ham, geologist for the Oklahoma Geological Survey.

These zones consist of porous, locally vuggy, bedded dolomites for the most part. The Royer dolomite is present as an easily recognized formation both in the Arbuckle and Wichita Mountains; it occurs near the base of the Arbuckle group. The other dolomite zones, the Butterly formation and a unit at the top of the West Spring Creek formation, are also found over a wide area on the Arbuckle Mountain outcrop.

Surrounded by production . . . The Arbuckle of southern Oklahoma has been a barren island surrounded by Kansas and Texas Arbuckle and Ellenburger production. Thus far, the biggest deterrents to testing the dolomite zones have been the depth to the pay zones and the fact that no Arbuckle production existed in the area except where the top had been eroded. Ellenburger production in Grayson County apparently was discounted. The Red River would be a "potent geological barrier," and would effectively prevent Ellenburger production of Texas from extending into Oklahoma to become Arbuckle production.

Significance of Arbuckle oil . . . Frankfort's successful test is only the forerunner of more Arbuckle wells. Many fields in southern Oklahoma cover deeper known Arbuckle anticlines. On some of these, the Arbuckle has been deeply eroded and these will be logical spots for Royer tests. Some of the structures have granite exposed at the Permian or Pennsylvanian unconformity. On these, flank stratigraphic traps may occur where an unconformity seals off the porous and permeable dolomite zones. Similar traps are well known in West Texas where the eroded Devonian and Ellenburger are productive.

So the Arbuckle is a promising reservoir in southern Oklahoma. It has several porous zones present on structures already uncovered by the bit. It will simply be a matter of time until the Arbuckle possibilities have been adequately tested.

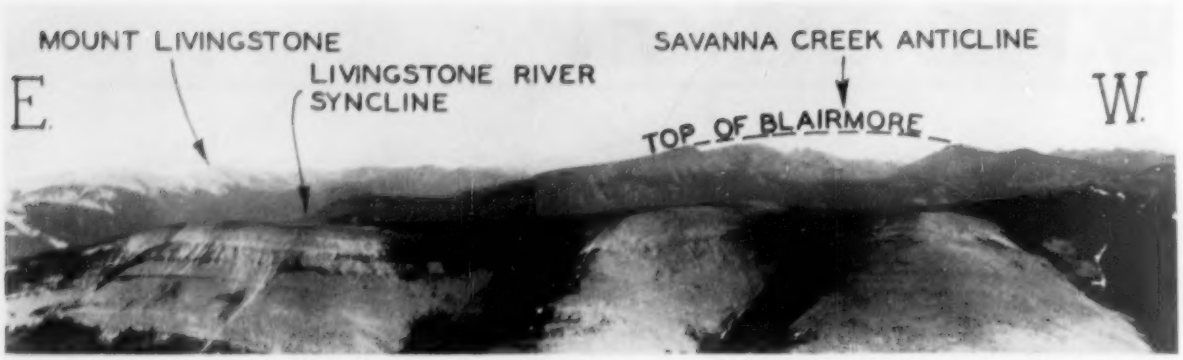

Fig. 1—Carboniferous limestone canyon wall, 1,500 ft. high, on Dry Creek. The flat-topped Savanna Creek arch is in the foreground, and the southward plunge of the fold in Mesozoic strata is to the right. The Husky well is in Dry Creek bed, below center of photo.

Canada's Mountains: A New Oil Frontier

. . . Savanna Creek strike quickens interest in this complex geologic area

by Joseph S. Irwin

THE recent discovery of more than 50 M.M.c.f.d of natural gas by Husky Oil & Refining, Ltd. and associates on the Savanna Creek structure has aroused interest in the mountain area of western Canada. The strike is located in the mountains 60 miles southwest of Calgary, Alta., and 25 miles southwest of Turner Valley oil and gas field.

Perhaps the most important feature of the Savanna Creek structure is the fact that it is in the true Rocky Mountain area, not in the foothills or "Disturbed Belt." The western boundary of oil and natural-gas possibilities in Alberta and adjacent Montana has generally been considered to be the Front Range of the Rocky Mountains.

This attitude is understandable, but should not be too rigidly respected. For these particular mountains are composed of the same Mesozoic and Paleozoic strata that yield oil and gas in the adjacent foothills and plains region. Remember too that the first well claimed to have been drilled for oil in Alberta (total production about 250 bbl.), was located near an oil seep in pre-Cambrian stratified rocks (but believed to originate in buried, overridden Cretaceous strata). This well was 4 miles west of Waterton Lakes, Alta., well within the Rocky Mountains, and 5 miles north of the Montana boundary. Prospectors, wildcatters, and some geologists have not, however, strictly observed the mountain front limit. And now, with the incentive of an apparently substantial discovery, general interest in the mountain province is developing.

Development . . . The sequence of exploratory and development events, related to the Savanna Creek structure, is this:

1. In 1937, W. D. McIlvride, a prospector of Calgary, was impressed by the spectacular anticlinal cross section exposed on Dry (Sunken) Creek and Savanna Creek (Fig. 1). With associates in Calgary, he took out a prospecting permit and engaged the writer to make a geological survey and report.

2. A planetable survey of the Savanna and Dry Creek portions of the structure was made by the writer during the period from June 26 to July 1, 1937. The northern portion of the structure was mapped during a five-day trip in June 1938. The objectives of these surveys were: first, to tie the map area to the nearest established land survey corners, for the area is in "unsurveyed territory"; and second, to determine the areal extent and height of any existing structural closure.

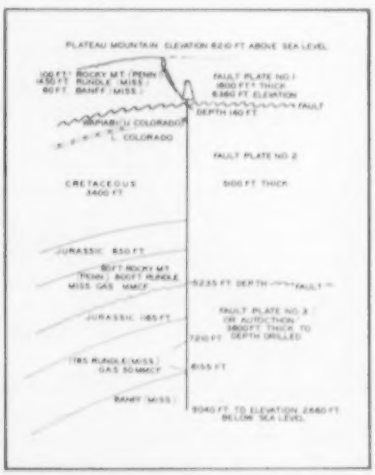

Fig. 2—Sketch of stratigraphic column as found in outcrop and in Husky et al. and Anglo-Canadian Savanna Creek wells.

Traverses and some triangulation were employed for location. To determine error or closure, it would have been desirable to join the north and south surveys which were tied to different established corners. But time and resources did not permit. The land net shown on the resulting map, Fig. 3, is therefore subject to correction by precise survey. Comparison, but not instrumental check, with the recent public-road survey makes it appear that positional errors are not critically large.

The determination of structural closure proved to have less significance than originally supposed. Later drilling revealed that the exposed structure was superficial, above a shallow, low-angle thrust fault. But the structural map does serve as a measure of the amount of folding subsequent to the thrust faulting.

3. Based on these surveys and the apparent similarity of the structure and formations to those of Moose dome (30 miles west of Calgary, where some light gravity oil had been produced from limestone of Devonian age at depth of 1,535 ft.), the writer recommended drilling in expectation of reaching the Moose dome Devonian producing zone at an approximate depth of 2,000 ft.

4. In 1939 Anglo-Canadian Oil Co., Ltd., drilled a test well with cable tools to a depth of 3,375 ft. at a location on Dry Creek near the structural crest. At 140 ft. this well penetrated a major

thrust fault — lowermost Rundle or uppermost Banff formation of Mississippian age overlying Wapiabi (Colorado or "Alberta") formation of Upper Cretaceous age. The Big Horn (Cardium) sandstone was reached at 390 ft.

Although several showings of oil and gas were noted in the various Blairmore (Lower Cretaceous) sands, no shooting, perforating, or fracturing was done. Finally, upon encountering a small amount of water in the Dalhousie (basal Lower Cretaceous) sand at 3,370-75 ft., the well and the entire project were abandoned.

The Anglo well proved two things: (a) the Cretaceous formations had minimum thickness and therefore must be nearly flat-lying like the visible Rundle (Mississippian) beds exposed in the canyon walls above the well; and (b) inasmuch as the fault at depth of 140 ft. (from limestone of Mississippian age to Wapiabi shale of Upper Cretaceous age) does not emerge west of the Livingstone River syncline, it must be close to parallel with the exposed bedding above. Therefore, it must be folded downward to the east, somewhat similarly to the exposed flexure in the Paleozoic.

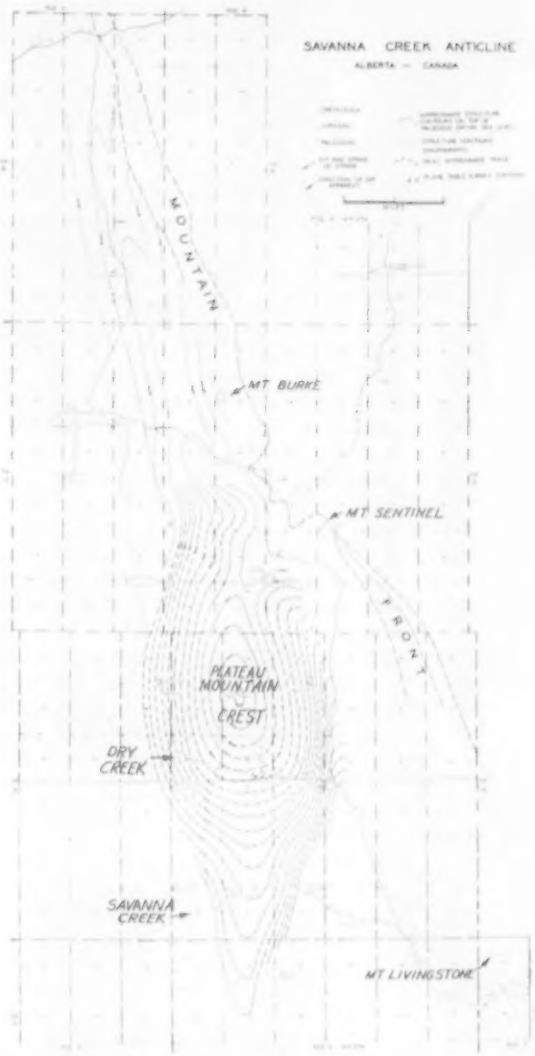

Fig. 3—Plateau Mountain crest, Savanna Creek anticline. Structural contours on top of Rocky Mountain formation (Permo-Pennsylvanian?). Contour interval: 100 ft.

5. Further reports were written by the author from time to time for various clients, including McIlvride and associates. These reports recommended testing of the Rundle limestone (main Turner Valley producing horizon) at an estimated depth of 4,400 ft. to the top. This was revised in the later reports to 5,200 ft. But the 4,400-ft. estimate proved to be nearly right.

6. Further development proved unsuccessful until, in 1951, Husky Oil & Refining, Ltd., undertook the task. This company's interest and confidence in the prospect were inspired by their chief geologist, J. C. Scott. He was well versed on the subject of folded faults, of which the Savanna Creek structure is an outstanding—and so far as known, first—productive example.

By this time a gravelled forestry highway, the Coleman-Kananaskis road, had been built within 100 ft. of the Anglo-Canadian abandoned hole and the site of the Husky Savanna Creek No. 1 well. In 1937, access and survey were by horseback and the Anglo-Canadian Co. operation in 1938 had required the building of a private access road costing $60,000.

7. Husky started drilling the well in 1952, at a site 1,100 ft. west of the Anglo well. They reached the Rocky Mountain formation (Permo-Pennsylvanian?) at depth of 4,375 ft. and the Rundle (Mississippian) at 4,440 ft. Minimum formation thicknesses and no repetitions to depth of 5,235 ft. were encountered below the shallow major fault revealed by the Anglo-Canadian drilling. But success was not yet attained. At 5,235 ft. the formation faulted from Rundle (Mississippian) to Kootenay (Jurassic). The lower, porous portion of the Rundle was cut off and only the upper, generally nonporous 800 ft., yielding 500 M.c.f. of gas on drill-stem test, had been penetrated.

8. Phillips Petroleum Co. then joined Husky in the project. Drilling was continued, the Rundle was again reached at 6,400 ft., the full section of Rundle was present, and the lower 940 ft., with many porous zones scattered throughout the interval from 7,210 to 8,150 ft., yielded an aggregate of more than 50 M.M.c.f.d. of gas.

What it means . . . Some of the conclusions that may be drawn from the Savanna Creek exploration and development are:

- The Rocky Mountain belt in western Canada and Montana cannot safely be ignored as a locale for petroleum and natural-gas exploration. In western Canada, three topographic categories of petroliferous provinces occur: the plains, the foothills, and the mountains.

- The folded Savanna Creek fault structure looks potentially profitable. The folding prior to the major fault repetitions by no means assures success, but it does add promise.

- Two superimposed fault plates, underlain by major low-angle faults, have been determined (Fig. 2). The upper plate, largely exposed as a mountain mass, is at least 1,600 ft. thick. The lower plate is 5,100 ft. thick. Beneath this pileup, a second repetition (third occurrence) of the sedimentary sequence has been penetrated for 3,800 ft. to total depth of 9,040 ft. below the wellhead, and 10,900 ft. below the mountain top. Whether or not additional deeper fault repetitions occur remains to be seen.

- In the highest, largely exposed

THE AUTHOR

Joseph S. Irwin is a consulting geologist in Calgary, Alta. A graduate of the University of Missouri, his career has included positions as geologist for Carter Oil Co. at Tulsa; Producers & Refiners Corp. at Denver; and Parco Oil Co. of Calgary. He entered the consulting field in 1932. He is a member of the A.A.P.G., Engineering Institute of Canada, C.I.M.M., and G.A.C. He is a past president of the Association of Professional Engineers of Alberta and the Alberta Society of Petroleum Geologists.

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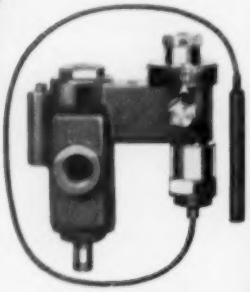

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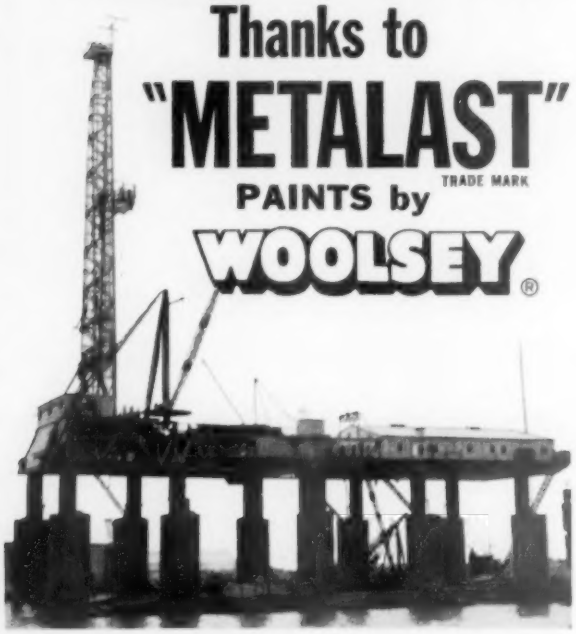

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fault plate, more than 100 ft. of Rocky Mountain formation (Permo-Pennsylvanian?) is present. Undoubtedly, some has been removed by erosion, because it forms a mountain top. In the next underlying fault plate, beneath a depositional contact, only 60 ft. of Rocky Mountain formation is present. In the third occurrence of the Rundle, Jurassic strata directly overlie Mississippian strata so that no Rocky Mountain formation intervenes. The more familiar disconformable and erosional contact between the Mesozoic and Paleozoic systems, as known in the foothills and plains, is present. These relationships reveal and give some measure of the progressively greater amount of eastward movement in each successively higher and younger fault plate.

● The north-south orientation of Plateau Mountain (Savanna Creek) field, in contrast to the northwest-southeast alignment of the mountain front (Livingstone Range) and frontal fault traces, may be more evidence of the true nature of the field.

● The Savanna Creek structure in both its exposed and subsurface aspects reveals some rather imposing glimpses of the mechanics of mountain building in stratified rocks.

EXPLORATION HIGHLIGHTS

MID-CONTINENT

KANSAS

New Pools Named by Nomenclature Committee

The Kansas Nomenclature Committee has labeled 14 new oil and gas pools in Kansas.

Traffas and Landis are new Barber County pools. Magnolia 1 Traffas, NW NW SE 6-33s-10w, made 1,462 M.c.f. of gas per day from the Mississippian; Purcell & Mull 1 Landis, SE SE SE 21-34s-11w, made 282 bbl. of oil per day from the Mississippian.

In Dickinson County Augusta Oil Co. 1 Kandt, SE NW SE 20-16s-4e, is a new Mississippian pool . . . Northwest Lost Springs. Elk County has a new pool at Franco-Central 1 Ware, NW NW NW 5-31s-9e, making 25 bbl. of oil per day from the Kansas City lime . . . opens Ware pool.

Southeast Wheatland pool was opened in Ellis County at 1 Rajewski, SW SW NW 28-15s-17w, by Cook & Galloway-Sunray Oil Corp. The discovery is completing in the Arbuckle. Progress pool was opened at K&E Drilling Co. 1 Funk, SE SE NW 10-16s-10w, Ellsworth County, with 3,000 bbl. of oil per day from the Arbuckle.

Sunny View is a new field for Kingman County. It was discovered at Pickrell Drilling Co. 1 Holcomb "A," SW SW SW 26-30s-9w. The discovery well made 1,500 M.c.f. of gas per day from the Mississippian. Anschutz Drilling Co. 1 Schartz, SE SE SE 14-22s-16w, opened North Shady pool for 3,690 M.c.f. of Arbuckle gas daily. Pawnee County has a new pool at West Carpenter, opened by Bay Petroleum 1 Fisher, NW NE NW 26-23s-17w, with production from the Cherokee sand.

H. L. Herbel 1 Guldner, SW NE SE 17-18s-9w, Rice County, is completing in the Arbuckle to open Guldner pool. South of Wichita in Sedgwick County Petroleum, Inc., has opened South Gladys pool with production from the Mississippian in W½ NW SW 5-29s-1e. Panhandle Eastern 2-20 Shuck, C NE SW 20-33s-34w, Seward County, was completed as a Morrow discovery for 5,000 M.c.f. of gas per day to open Shuck pool.

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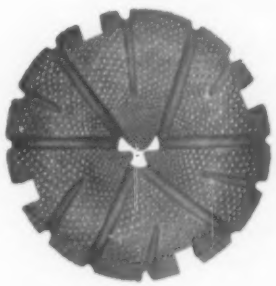

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NE 27-31s-1w, Sumner County, opened Northeast Wellington pool with Mississippian production. O'Hara pool was opened in Sumner County at Stelbar Oil Co. 1 O'Hara, NE SE NW 18-32s-1w. The well was finaled for 423 bbl. of oil per day from the Kansas City lime.

Four New Fields Opened in Kansas

Four new producing areas were opened in Kansas last week. Two were new oil pools, and two were gas strikes.

Globe Refining Co. and B. M. Heath 1 Goemann, NW NE NW 29-32s-10w, Barber County, made 16 bbl. of oil daily from chat perforations. This well is 2 miles northeast of production in Traffas field. Aladdin Petroleum Co. 1 Voils, NE NE NE 27-31s-1w, Sumner County, opened Northeast Wellington field with 258 bbl. of oil daily from the Mississippian.

The new gas fields are in Kingman and Pawnee County. Cities Service Oil Co. et al 1 Dix, SW SW SW 21-21s-15w, made 3,762 M.c.f. of gas per day from the conglomerate to open the Pawnee field; Magnolia 1 Wells, C SE SW 17-30s-8w, made 1,640 M.c.f. of Mississippian gas to open the Kingman pool 1 mile southwest of Northwest Spivey field.

OKLAHOMA

New North Madill Wells Completed by Sinclair

Sinclair Oil & Gas Co. has completed a 329-bbl. oil well in North Madill field, Marshall County. The 1 Taliaferro, SE SE SW 14-5s-5e, an eastern extension well, flowed the 36°-gravity oil in 9 hours on ½-in. choke. Gas measured 467 M.c.f. of gas per day. The pay section is the second Bromide sand at 6,240-6,312 ft.

The same firm's 1 Beard in NE SE SE 15-5s-5e is making production tests of two zones in the second and third Bromide sands at 6,112-32 and 6,220-70 ft., respectively.

Three New Wells Added To West Short Junction play

Three completions in Cleveland County's West Short Junction field have enhanced the favorable prospects of this new field. Continental Oil Co. 1 Fry, C SW NE 22-10n-4w, flowed 170 bbl. of 38°-gravity oil in 6 hours on 21/64-in. choke from Hunton perforations at 8,069-8,422 ft. Their 2 Fry, C NE NE 22, is drilling below 7,648 ft. The 2 Castlebury, C SW NW 22, flowed oil from the Chimney Hill. Sun

Oil Co.'s 2 Rowland, on the western end of the field, swabbed 9 bbl. of oil per hour from 8,292-8,324 ft. That well is in the C NE SE 17-10n-4w.

East Noble Pool in Cleveland Extended South

Cleveland County's East Noble pool has been extended to the south by Carter Oil Co.-Pure Oil Co. 1 McMakin Unit, NW NE NW 31-8n-1w.

The lower Bromide sand well flowed 123 bbl. of oil in 4 hours on ½-in. choke from perforations at 7,889-7,917 ft.

New Pay Discovery for South Lone Grove Area

A new-pay discovery is indicated on the south flank of Carter County's Lone Grove field where Frankfort Oil Co. has established important Arbuckle and Viola lime production.

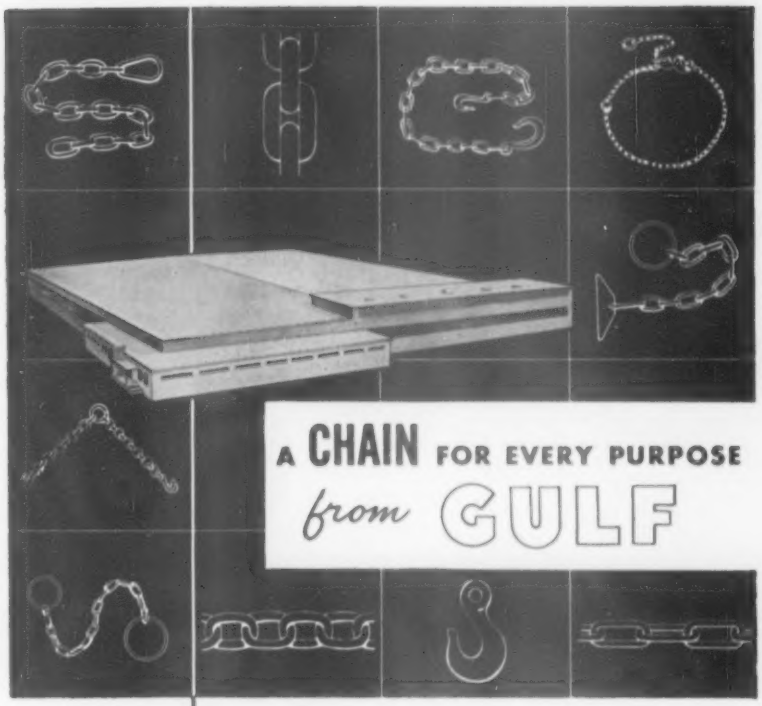
The new success is the 1 Greenwood in NW SW NW 12-5s-2w. The drill entered the lower Dornick Hills at 5,292 ft., finding a showing of oil. The sand was found at 5,320 ft. The well flowed at the rate of 25 bbl. per hour on drill-stem test at 5,306-32 ft. Gravity was 40°. Recovery on the test was 2,500 ft. of clean oil. A test made at 5,331-62 ft. flowed oil at the rate of 20 bbl. hourly. Gravity was 39°.

The lower Dornick Hills prospective pay sand is stratigraphically near the Lake Ardmore part of the Springer-Pennsylvanian sand. This well also indicated Hunton lime production. Despite these indicated new pays the Viola reservoir is the outstanding exploratory story in this sector of Oklahoma. The Viola trend is indicated from 19-4s-3w to the Brock townsite area; 19-5s-1e and southeast to Love County's North Marietta field, another new Viola pool in 34-6s-2e.

The Viola lime in this trend ranges in thickness from 300 to 1,200 ft. It is estimated that the recovery from the Viola will approximate 20,000 bbl. per acre. There are 10 active operations along the trend with this number to increase in the next few weeks.

Oil Moves Into North Oklahoma's Alfalfa County

Oil production has moved across the Grant County line in northern Oklahoma to the west side of Eureka field in Alfalfa County. Vierson & Cochran 1 Landreth, NW NE SE 12-28n-9w, flowed 36 bbl. of oil is 13 hours on ¼-in. choke. Perforations were in the Bartlesville sand at 4,935-52 ft. Bartlesville production was recently established



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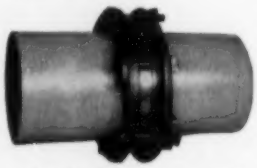

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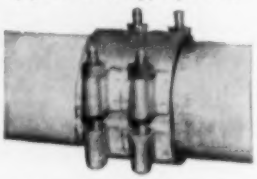

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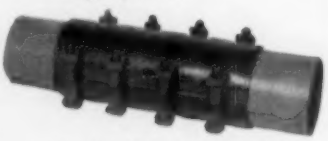

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NORTH TEXAS

Southern Stonewall County Gets Big Strawn Discovery

Stonewall County gained a Strawn pool at J. R. McLean and J. D. Tompkins 1 Martin, 11 miles south of Aspermont. Calculated daily potential of 422 bbl. of 42° oil was based on an 18-hour gage of 316.68 bbl. through 12/64-in. choke. Final perforations were from 5,400-12 ft. Gas-oil ratio was 345:1 and tubing pressure was 575 psi.

Location of the new well is in Section 137, Block 1, H&TC Survey, which is 1½ miles west of the one-well Vardeman-Strawn pool. The Vardeman discovery had pay around 5,310 ft.

HUGOTON EMBAYMENT

SOUTHWEST KANSAS

Gage Reported at New Morton Morrow Producer

Morton County in extreme southwestern Kansas has a new Morrow sand (Keyes) gas field. It was opened at Musgrove Petroleum Co. 1-11 Jones, SE NW 11-35s-43w, 11 miles northwest of Elkhart and 4½ miles southeast of big Greenwood field.

The gage was 1,400 M.c.f. of gas daily from perforations at 4,558-72 ft. Topeka production was also indicated at the wildcat. The new gas area is 3 miles southeast of oil production at Interstate-Morrow field.

Chase Group Discovery Hinted in Finney County

There are good indications of a new Chase Group Permian gas discovery 2½ miles northwest of Hugoton field's limits in Finney County. The indicated strike is M. A. Machris 1 Foster, NE SW 8-21s-34w. Gas was found at 2,628 ft. No gages are reported.

Morton Discoveries Testing in Morrow

Two discoveries in the Greenwood field area of southwestern Kansas are testing. They are Stanolind's 1 Kansas City Life in the Interstate field area, and Panhandle Eastern Pipeline Co.'s 1-11 Jones, to the southeast of Interstate field.

Oil production is assured at the Stanolind well from the basal Morrow or Keyes sand at 4,454-60 ft. It

swabbed 8 bbl. of oil hourly after fracturing. Gas also flowed from the upper Morrow sand pay. The 1-11 Jones well flowed 1,150 M.c.f. of gas per day from the Keyes sand at 4,558-72 ft.

Big Oil Flow Reported At Meade County Wildcat

Colorado Oil & Gas Co. 1-3 Leslie is a promising new Morrow sand discovery for southwestern Kansas' Meade County area.

The wildcat reported an estimated flow of 50 bbl. of oil per hour on drill-stem test of the Morrow sand at 5,673-93 ft. The test well is in NW NE 3-33s-30w, 3 miles south of the town of Plains and 2 miles north of Northeast Bruno-Morrow gas field.

OKLAHOMA PANHANDLE

Camrick Field Is Extended Three Miles to Northwest

Camrick field oil production in Texas County has been extended 3 miles to the northwest by Carter Oil Co.

The 1 Haley-Peery Unit, NE NE SW 4-1n-19eCM, swabbed 31 bbl. of new oil in 9 hours natural with 75 M.c.f. of gas per day on first production tests in the Morrow sand at 6,676-95 ft.

Beaver Outpost Well Testing the Toronto

Carter Oil Co. is testing Toronto pay prospects at the 1 Baldwin-Evans, NE NE SW 7-5n-25eCM, 1 mile west of Mocane field in Beaver County.

TEXAS PANHANDLE

New Cisco Field Opened In Northeastern Dallam

Dallam County has its third Cisco lime gas field. It is Shamrock Oil & Gas Corp. 1 Ruth Foxworth Skaer et al, Section 89, Block 1-T, T&NO Survey, 7½ miles northwest of the town of Stratford. The new field opener, located 5 miles southeast of Kerrick field and 5½ miles southwest of Stratford field, flowed 3,158 M.c.f. of gas per day from perforations in the Cisco lime at 3,460-92 ft. A ¾-mile southeast stepout test has been announced.

Big Tonkawa Gas-Distillate Well Completed in Hansford

The North Hansford field in Hansford County received a prolific Tonkawa sand gas-distillate well at Sharples-Taylor 1 Beck, Section 8, Block 2,

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SA&MG Survey, 8 miles northeast of the town of Gruver.

The well flowed 58,000 M.c.f. of gas plus an unknown amount of distillate daily from Tonkawa-Penn perforations at 5,352-92 ft. The well was acidized and fractured. The big well is 1 mile west of the 1 Boyd discovery well which made 109,000 M.c.f. of gas and 545 bbl. of distillate per day.

Hansford County Pre-Permian Exploration Rolls Onward

Another discovery for the north-central Hansford County play is in the making at Sharples Oil Corp.-Baker-Taylor Drilling Co. 1 Betty, Section 24, Block 1, Cherokee Iron & Furnace Co. Survey, 12 miles northeast of Gruver.

The wildcat flowed 4,500 M.c.f. of gas per day from perforations in the Marmaton-Des Moines at 5,870-90 ft. The well also has Morrow gas production in prospect. The new pool-opener is 4½ miles south of Hitchland-Douglas field and 4 miles northeast of new multipay North Hansford field.

. . . Coats Drilling Co. 1 S. P. Miller estate, 10 miles northeast of Gruver and 4 miles northwest of North Hansford field, reported an estimated open flow gage of 32,000 M.c.f. of gas per day with 9 bbl. of distillate per million. The Coats well is the first Marmaton lime pay in the Hansford County race.

. . . In North Hansford field Sharples-Baker-Taylor 1 Cox Gas Unit, 9 miles northwest of Spearman, flowed 7,000 M.c.f. of gas per day from 7,281-7,301 ft. The sand is in the lower Morrow, a new pay for the area.

. . . On the field's north flank the 1 Harvey Gas Unit is an extension to Morrow gas production. The well is 1 mile east of the Tonkawa gas discovery in the field. It is 2 miles northeast of closest Morrow sand wells.

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WEST TEXAS

Crockett County Wildcat Is Gas-Distillate Prospect

Cities Service Oil Co. 1-E Noelke, 9 miles northeast of Sheffield, was showing for a Cusco discovery west of Olson field.

On production test between 5,580-85 ft. the well flowed 174.24 bbl. of 37° oil, plus 76.4 bbl. of water in 17 hours. The flow was through 12/64-in. choke under pressure of 575 psi. Gas-oil ratio was 675:1.

Broken down, the well flowed 62.33 bbl. of oil the first 4 hours; then 38.63

Cities Service Oil Co. 1-E Noelke flowed heavily while testing the Cisco.

bbl. in 5 hours, and 73.28 bbl. of oil in 8 hours. Flowing pressure remained steady. This well first assured production when it flowed at the rate of 120 bbl. an hour on a drill-stem test at 5,511-90 ft.

Queen discovery in Nolley field . . . A second pay, Queen sand, has been added to Nolley-Wolfcamp field in northeastern Andrews County. Cabot Carbon Co. 7 Nolley, twin to a Wolfcamp producer, in 8-314-Gaines CSL, fractured open hole at 4,490-4,522 ft., and after flowing out load oil, gaged

200 bbl. of new oil in 9 hours, flowing through casing. Nearest Queen production is 2 miles west in Means field. Location of 7 Nolley is on the south side of Nolley field.

New Cisco oil in Coke . . . Kewanee Oil Co. 1 Byrd, wildcat 3 miles northeast of Robert Lee, indicated production from the Gonzales sand section. Drill-stem test from 4,369-94 ft. recovered 460 ft. of gas and 345 ft. of oil in 2 hours. Flowing pressure was 165 psi. The well indicated additional sand section in drilling to 4,450 ft., total depth. Top of the sand was 4,350 ft. on elevation of 1,939 ft. Location is in 417-1A-H&TC Survey.

GULF COAST

TEXAS GULF COAST

Oil Discovery Reported at Jackson's Appling Field

Oil production has been opened at Appling gas-condensate field in southern Jackson County. The discovery well is Aluminum Co. of America-Crown Central Petroleum Corp. B-3 F. E. Appling, 3,750 ft. southeast of field production in the Wm. Ahlert Survey, Abstract 90.

The well flowed 222 bbl. of oil per day on 9/64-in. choke from perforations at 8,521-25 ft., 40.5° gravity.

Midfields Wildcat Opens New Gas-Condensate Area

Roy Gardner and Cyprus Oil Co. have opened a new gas-condensate reservoir about 1½ miles south of their oil and gas production in and around the townsite of Midfields, in northwestern Matagorda County.

Their new discovery well, 1 Woodson, in the John H. Wade Survey, is rated good for 76,000,000 cu. ft. of

Location (indicated by arrow) of Roy Gardner's and Cyprus Oil Co.'s new gas-condensate well south of Midfields, in northwestern Matagorda County.

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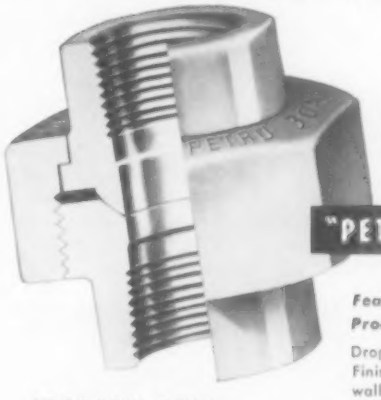

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gas daily on open flow. Condensate recovery on completion test was at the rate of 1 bbl. to 116,000 cu. ft. of gas. Condensate gravity is 53.6°. The well is shut in with pressure of 2,542 psi.

Production is from an upper Frio sand, perforated at 6,599-6,607 ft. Oil production at Midfields is from Frio sands below 8,800 ft. It was discovered in June 1953.

SOUTHWEST TEXAS

New Oil Pay Opened In Starr County Area

A new oil pay has been established in Starr County's Strong field. The discovery well is the Wymore Oil Co. 1 Vidal Perez, 26 miles northeast of Rio Grande City in the TTRR Survey 193.

The well recovered 210 ft. of oil on a drill-stem test at 4,394-96 ft. Strong field produces from the 4,650-ft. zone. There are 14 oil wells and one shut-in gas well in the field.

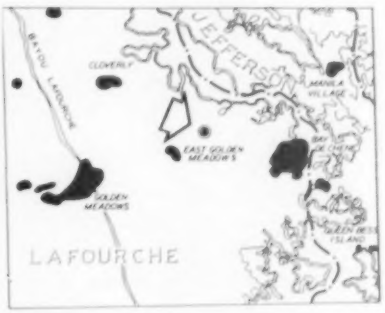
Gonzales County Strike Opens Pilgrim Field

A. T. Jergins 1 Tenberg, Gonzales County discovery 5 miles north of Wrightsboro, has opened Pilgrim field flowing 150 bbl. of 24°-gravity oil per day on ¼-in. choke from perforations at 3,341-42 ft. The discovery well is in the Wm. Newman Survey, A-362.

SOUTH LOUISIANA

New Oil Pool Opened In Lafourche Parish

Natural Gas & Oil Corp. with Humble have completed the 1 Lafourche Parish School Board to open a discovery area 3 miles northeast of



East Golden Meadow field, 16-19s-23e. The well flowed at the rate of 240 bbl. of oil per day from perforations at 9,755½-9,760½ ft.

Plaquemines Oil Discovery Takes Potential Test

Potential test has been run at John W. Mecom and Freeport Sulphur 1 LL&E-Unit A, 2 miles northeast of Lake Washington field. The well flowed 211 bbl. of oil per day from perforations at 13,978-90 ft. on 12/64-in. choke. This strike is in 32-19s-27e.

MISSISSIPPI

Jones County Strike Completed in Xmas Zone

An Xmas sand (Eutaw) discovery has been completed on pump in the Sandersville field area of Jones County. It is Central Oil Co. 1 Mrs. M. J. Sanders et al, 5-9n-10w.

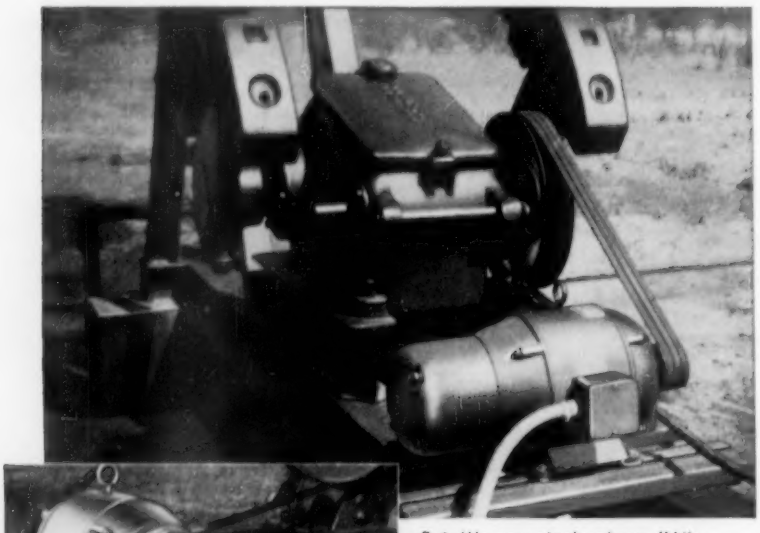
The well pumped 170 bbl. of 14°-gravity oil in 24 hours on state potential test. Perforations are at 5,590-5,600 ft.

ARK-LA-TEX

EAST TEXAS

Limestone County Discovery Ready for Completion Attempt

Zephyr Oil Co. 1 Myrtle Norris, prospective dual discovery from the Pettit limestone and the upper Glen Rose, was installing pump for comple-



R & M's new single-phase "All-Weather" motor—specially designed for oil field use—has a removable "hat" over condensers and centrifugal switch, enabling you to inspect these parts *even while the motor is running.*

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tion tests. Location of the well is 4 miles west of Thornton.

No. 1 Norris flowed an estimated 100 bbl. of oil a day from the Pettit at 5,413-33 and 5,454-64 ft., and swabbed oil from the Glen Rose at 4,455-63 ft.

Cherokee County . . . Humble Oil & Refining Co. 1 Wipprecht, 7 miles south of Reklaw, showed gas and distillate on a drill-stem test in the Pettit at 8,447-8,525 ft. On the 51-minute test, gas flowed in 3 minutes, with maximum surface pressure of 235 psi. Pipe recovery was 20 ft. of distillate and 90 ft. of water. This well also indicated gas in the Rodessa at 7,725-7,936 ft. The project is a Travis Peak wildcat.

Mount Selman confirmation . . . The Mount Selman sub-Clarksville sand gas field gained its second well at P. G. Lake and Eugene Talbert 1 Phillips. Completion potential was 15,000 M.c.f. of gas per day, with a gas-liquid ratio of 129,000:1. Choke size, if any, and pressures were not reported. Location of the new pool is 4 miles north of Mount Selman, in the G. Stokes Survey.

EASTERN INTERIOR

ILLINOIS

In Clay County, 8 miles northwest of Louisville, Ill., A. A. Richey 1 General American Life, SE SE NE 13-5n-5e, was completed for 513 bbl. of oil per day flowing from the Rosiclare lime at 2,420-77 ft. The south offset well, the 1 Gracie Harper, NE NE SE 13-5n-5e, is testing in the Rosiclare at 2,428-36 ft. The well is 1½ miles east of Iola Consolidate pool.

● In Hamilton County Fitch and Grant 1 Johnson, SE NE NW 33-6s-5e, was finaled for 960 bbl. of oil per day from the Aux Vases at 3,258-86 ft. after fracturing. This discovery is 5 miles northeast of Thompsonville and is ½ mile from production.

● The Eldorado play in Saline County has come up with six good wells in the last 2 weeks by George & Wrather Oil Co., alone. The wells' production amounted to 10,488 bbl. for initial production. One well was completed for 2,040 bbl. per day.

APPALACHIAN

PENNSYLVANIA

In Cherry Hill Township, Indiana County, Southwest Pennsylvania, Manufacturers Light & Heat Co. has located 1 A. & H. A. Bonnett, rank wildcat, elevation 1,691 ft., Indiana Quad-

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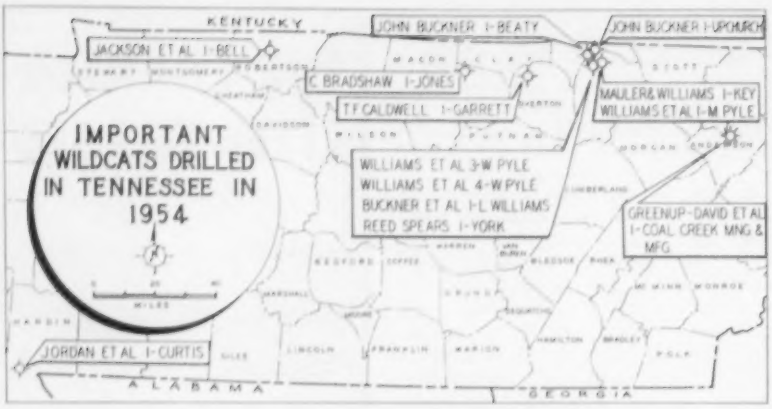

rangle, 3.18 miles south of latitude 40 degrees 40 minutes and 1.42 miles west of longtitude 78 degrees 00 minutes.

WEST VIRGINIA

Circleville district, Pentdleton County, West Virginia, Columbian Carbon Co. 2-1203 U.S.A., rank wildcat, elevation 3,911 ft., was dry, chert 6,154 ft., Oriskany sand 6,261 ft., show of gas at 6,263 ft., total depth 6,450 ft.

● Grant district, Jackson County, D. D. Foster 1 Loyd Burdette, elevation 915 ft., gaged 1,300,000 cu. ft. of gas, natural, 1,650 psi., Oriskany sand. Total depth 4,427 ft.

● Logan district, Logan County, Columbian Carbon Co. 1213 Coal & Crane Tract No. 2 in development drilling gaged 19,000,000 cu. ft. of gas in the Big lime, total depth 2,659 ft. This completion will cause more drilling in this area.

OHIO

Two of the active pools at Glenford in Hopewell Township, Perry County, reported completions: National Gas 1 Ralph Yost, Section 7, with Clinton at 2,719-2,748 ft., gaged 100,000 cu. ft of gas and 15 bbl. oil natural and 700,000 cu. ft. and 65 bbl. in a 24-hour test 3 weeks after fracturing; Clyde Foraker, Jr., 1 Love-Ice, Section 8, logged the Clinton at 2,792-2,823 ft. with 3 bbl. natural and 130 bbl. in 24 hours after treatment.

● On the east edge of Greer pool, Allen Willey 2 Stephens, Section 25, Knox Township, Holmes County, found the Clinton at 3,113-58 ft. and made 250 bbl. oil and 500,000 cu. ft. gas after fracturing.

EASTERN KENTUCKY

On Lower Chloe Creek in the Pike County sector of Big Sandy gas field, R. Holcomb has completed 1 Lizzie Syck as a Devonian black shale gas well. Bottomed at 2,998 ft., well gaged initially at the rate of 852,000 cu. ft. of gas daily.

PACIFIC COAST

CALIFORNIA

Texaco Scores Fresno Find

The Texas Co. successfully completed a wildcat 1½ miles southeast of Burrel field, Fresno County, as a small oil producer. After drilling to 8,275 ft., 1 Burrel Ranch was plugged back to 6,808 ft. for completion in the Zilch

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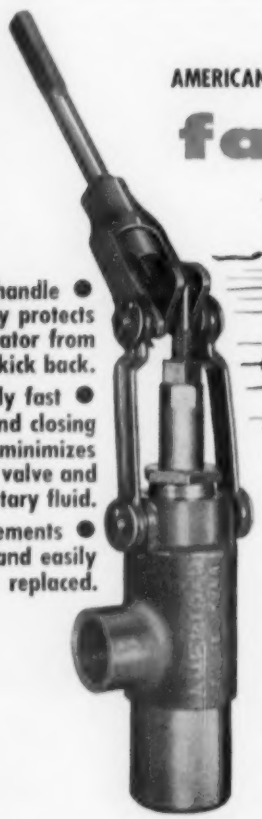

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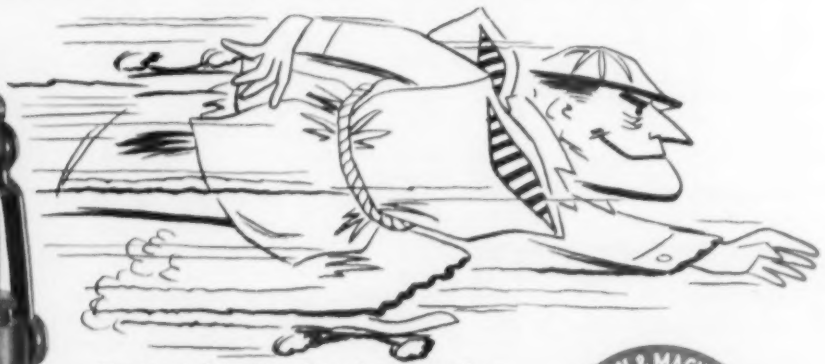

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sand (Middle Miocene) at 6,795-6,803 ft. Production was about 50 bbl. of 30°-gravity crude through 8/64-in. choke, cut 45 per cent.

Shell Completing Kern Oil Find

Shell Oil Co. was in process of completing a deep test in the Canal area west of Bakersfield, Kern County, as an oil discovery of more than average importance. Pipe was set at 13,028 ft. in 1 Posuncula after drilling to 14,224 ft. Drill-stem tests at 9,500 ft. and 12,400 ft. indicated commercial production. Tests near the 14,200-ft. level, probably in rocks of Eocene age, reportedly were not very encouraging.

The 12,345-12,438 ft. test of mid-April produced a strong flow of 31°-gravity crude. The sands tested were of Vedder age, Lower Miocene. Though highly productive on the east side of San Joaquin Valley, Vedder sands have not produced near the Posuncula well.

Last February a 1-hour test at 9,535 ft., in lower Stevens sands of Middle Miocene age, resulted in about 100 bbl. of oil being produced. Location of the wildcat is in NE NE 12-30s-25e, between Canal and Strand fields.

Willows Outpost Produces

A wildcat 1½ miles south of Willows gas field, Glenn County, was completed as a small gas discovery by General Petroleum Corp. Its 30-1 Capital, in 30-20n-2w, rated an initial production of 890 M.c.f. through an 18/64-in. choke. Production was from the interval 4,812-75 ft., after plugging back from 7,963 ft., total depth. Another General Petroleum outpost, 17-2 Capital in Section 17, was completed flowing 4,600 M.c.f. through perforations at 5,646-95 ft.

Montalvo Test Watched

An outpost to West Montalvo field of Ventura County was being watched after 7-in. pipe was set at the near-bottom depth of 12,050 ft. E. L. Doheny, Operator 1 Richfield-Laubacher in NW NW 5-1n-22w, previously had been freeing stuck drill pipe for several days. The wildcat, located about 1 mile west of Oxnard, is about 1 mile southeast of the edge well Sunray Mid-Continent Oil Co. completed in January. Midway between these two wells the latter's 1 Ohio-Kraemer Del Cielo was nearing the 12,000 ft. mark.

Three Princeton Tests Staked

Three new tests were staked for the Princeton gas area of Colusa County in Sacramento Valley. About 2 miles south of production R. S. Rheem, operator, will drill 1-12 Zumwalt in 12-17n-2w. Honolulu Oil Corp. will drill 1 Honolulu-Humble-Poage in 25-18n-2w and 1 Tuttle Unit in 12-17n-2w.

Guijarral Hills Test Staked

The Texas Co. has staked a 11,000-ft. test ¾-mile east of 8,500-ft. Miocene production and 1½ miles north of the new 10,500-ft. Eocene pool at Guijarral Hills, Fresno County. Texaco 1 Spieler, in SE SE 26-20s-16e, will be its first test in this expanding development.

In the Eocene area of 1-21s-16e, Standard Oil Co. of California and Los Nietos Co. each had two rigs busy after completing two prolific producers. In addition Standard was drilling 54 1H as a west offset to a well which tested 1,000 bbl. daily in the shallower Sanger sand before being completed in the 10,600 ft. Eocene.

ROCKY MOUNTAIN

COLORADO

Phillips County Wildcat Is Apparent Discovery

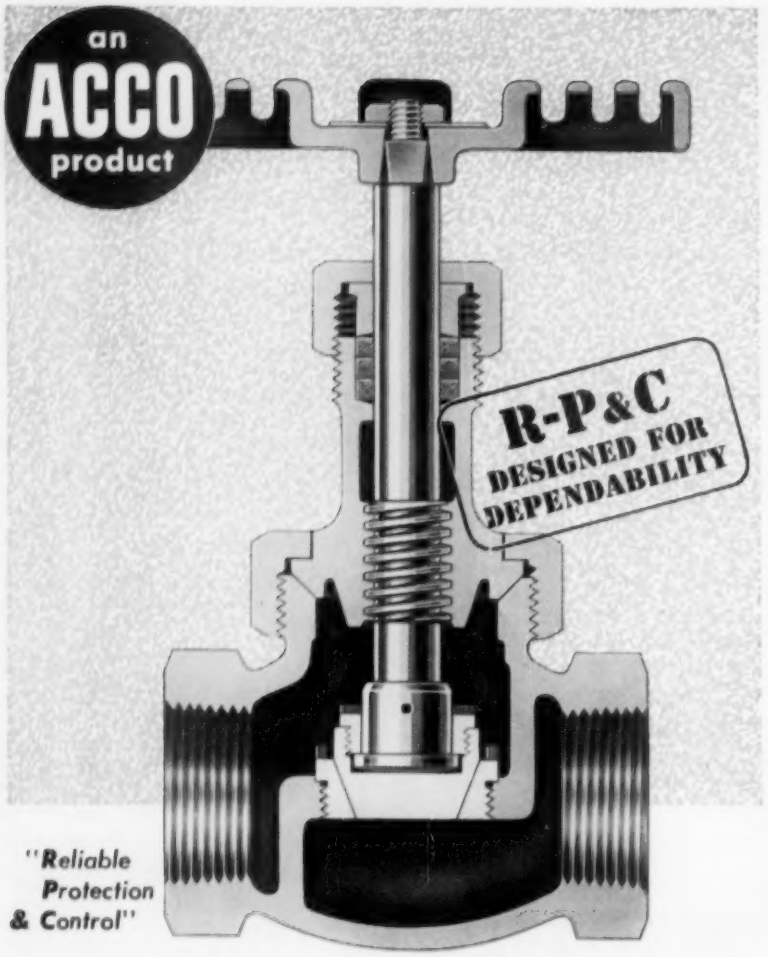
Stanolind Oil & Gas Co. recovered gas at the rate of 1,300,000 cu. ft. and at the rate of 1,500,000 cu. ft. per day on tests of two zones at 1 Scott, C NW SE 31-9n-47w, Phillips County. The zone 3,970-75 ft. flowed at the 1,500,000 cu. ft. rate, and a test at 4,020-23 ft. flowed 1,300,000 cu. ft. per day. Total depth is 4,064 ft., and the operator is running pipe. Both tests were in "J" sand. The wildcat is 4 miles north of the town of Haxtun, and is the first apparent producer in the county.

May Issue of Williston Wildcat Map Released

The May wildcat map of the Williston basin, published by the Midland Map Co. at 412 North Big Spring,

LEGAL

Sealed bids will be received until June 9, 2:00 P. M. Mountain Standard Time, and opened at that time in the office of the Superintendent, Fort Belknap Consolidated Agency, Harlem, Montana, for the leasing of 5,371.93 acres of Tribal land and 27,600.12 acres of allotted Indian land located in Township 30 N., Range 24 E., Township 31 N., Range 24 E., Township 31 N., Range 25 E., and Township 30 N., Range 25 E., Blaine County, Montana for oil and gas mining purposes. For further detailed information and a list of lands advertised call or write: Darrell Fleming, Supt. Fort Belknap Consolidated Agency, Harlem, Montana, Telephone 5-R-4.



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Midland, Tex., has been released. New issues of this Williston map appear shortly after the first of the following months: January, March, May, July, September, and November.

MONTANA

Glacier County Gas Recovery Reported

Union Oil Co. of California has recovered gas on drill-stem test in the upper Madison at its rank wildcat in Blackfoot Indian Reservation, Glacier County. The company has not confirmed reports that a flow of gas at the rate of 1,740,000 cu. ft. per day was tested from the interval 8,956-89 ft. Union did confirm recovery of some gas, with the test not evaluated. No tops have been reported, and designation of the test as in Madison is unconfirmed. The wildcat, 1 Morning Gun, C SW SW 18-31n-11w, is in the Disturbed Belt along the Rocky Mountain front in northwest-central Montana. The Pincher Creek gas field in Canada is similarly located, and has production from Mississippian formations. Success in the Canadian portion of the Disturbed Belt has been a major factor in generation of interest in the Montana area between the Sweetgrass arch and the mountain front.

Union is reported coring ahead in the wildcat. It is 20 miles south of a location recently made by Continental Oil Co. in the Milk River area. The Continental wildcat is also to test Madison.

WESTERN CANADA

ALBERTA

Forest Lawn Area Wildcat Reacidizing for More Tests

Following perforations and acidization of a 100-ft. interval in the Crossfield member of the Devonian, Socony-Vacuum Oil Co. of Canada, Ltd., flowed gas at the rate of 800 M.c.f. per day on 9/64-in. choke at its wildcat in the Forest Lawn area, a few miles east of Calgary city limits. The well, Socony 36-10 Calgary, LSD 10, 36-24-29w4, is 4 miles northwest of Forest Lawn and the same distance east of the airport. Crew is reacidizing the perforations in an effort to obtain more commercial results.

Potential Test Run at Sundre Follow-Up Well

Hudson's Bay Oil & Gas Co., Ltd., has run initial potential test at its first follow-up to the Sundre Mississippian

oil discovery, and has been assured of oil production at another test, the third, in the area. These wells are 23 miles northwest of Olds, and 60 miles northwest of Calgary.

The first well, Hudson's Bay 3-3 Sundre, LSD 3, 3-34-5w5, is ½ mile east of the Sundre discovery well. After perforating the Mississippian, test was run which got a flow of 349 bbl. of oil per day. The 15-4 Sundre well, the third to be drilled in the area, is ¾ mile northwest of the discovery well. During a test at 9,193 ft. the well flowed oil to the surface in 36 minutes and recovered 200 ft. of clean oil. Crew is coring ahead prior to further testing operations.

BRITISH COLUMBIA

Significant Gas Discovery Reported at Paddy River

The team of Imperial Oil, Ltd., Hudson's Bay Oil & Gas Co., Ltd., and Union Oil Co. of California, has recorded a very significant gas discovery in the Paddy River area of northeastern British Columbia, according to unofficial, but reliable report. During a drill-stem test in the Devonian the wildcat flowed more than 8,000 M.c.f. of gas per day. The 1 Paddy well is about 110 miles north of Fort St. John and 8 miles west of the Alberta-B. C. border. It is 80 miles north-northwest of gas wells in the Buick Creek area.

SASKATCHEWAN

Jurassic Oil Found At Rosscommon Creek

Seaboard Oil Co. has found oil at a well in the Carmichael area of Saskatchewan 50 miles southwest of Swift Current. It is Seaboard-Canadian Devonian 4-20 Rosscommon Creek, LSD 4, 20-12-20w3, 2 miles west of a dry hole. The well recovered oil on drill-stem test of the upper Shaunavon at 3,838-56 ft.

BASIN AND RANGE

ARIZONA

Arizona Test Staked

Humble Oil & Refining Co. has staked ½-mile west outpost to the gas discovery recorded by Shell Oil Co. last October in the East Boundry Buttes area of Arizona. The test will be 1 Navajo Tribal in NE SE 4-41n-28e, Apache County. Shell 2 East Boundry Buttes was completed flowing 2,200 M.c.f. of gas daily from the plugged back depth of 4,884 ft.

Successful Wildcats

SOUTHWEST TEXAS

Dimmit County: Howeth & Mason et al 7 Crenshaw est., Narcisco Aguire Sur. IP 13,500 M.c.f. daily, open-flow potential, GOR 100 M.c.f. per barrel, 40°, perforations 4,350-75 ft. and 4,379-86 ft. TD 4,450 ft. (New pay in Elaine field.)

Jim Wells County: L. G. Shelly and Texas Southern Oil & Gas Co. 4-1 Muil, J. Poitevent Sur. 205, A-371. IP 6,600 M.c.f. daily, open-flow potential, pressure (shut-in) 1,563 psi., perforations 3,597-3,607 ft. TD 5,670 ft. (New pay in Clark Muil area.)

TEXAS GULF COAST

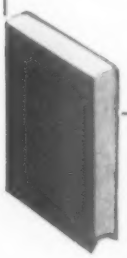
Brazoria County: Beck Oil Co. 1 Tiger & Bingham, Francis Bingham Sur., A-43. IP 120,000 M.c.f. daily, open-flow potential, GCR 48,340 cu. ft. per barrel, 57.8°, perforations 7,668-70 ft. (Frio). TD 8,236 ft. (New pay and extension in Juliff area.)

Calhoun County: Layton Brown Drilling Co. 1 Traylor, Juan Maldonada Sur., A-120. IP 188.56 BOPD, 7/64-in., 39°, perforations 8,327-31 ft. TD 8,705 ft. (New field, Olivia.)

Galveston County: Superior Oil Co. 1-B Cooper, Block 48, I&GN Sur. 13, A-160. IP 12,800 M.c.f. daily, open-flow potential GCR 18,820 cu. ft. per barrel, 43.7°,

An outstanding oil expert explains

the role of American companies in the global revolution in oil



How Americans are in the forefront of a truly global revolution in oil, what these changes are, and what they mean to free nations is told in this book. The author, an oil expert, reports on how U. S. companies are carrying on foreign oil operations, despite pressures, and what special factors are involved in bringing oil out of underdeveloped countries. The author analyzes overseas oil operations in Mexico, Venezuela, the Near East, Canada, and many other lands.

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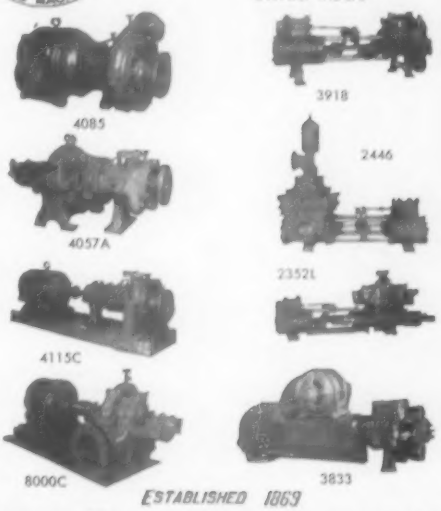

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perforations 11,514-24 ft. TD 11,904 ft. (New pay and extension in Algoa area.)

Jackson County: Aluminum Co. and Crown Central Petroleum Corp. 3-B Appling, Block 16, William Ahlert Sur., A-90. IP 222.07 BOPD, 9/64-in., 40.5°, perforations 8,521-25 ft. TD 8,602 ft. (New pay in Appling field.)

Jefferson County: Adams & Haggarty 10 Marrs McLean, EL&RR Sur. 373, A-551. IP 131.54 BOPD, ⅛-in., 29.6°, perforations 5,708-13 ft. (Miocene). TD 5,900 ft. (New pay in Big Hill field.)

Liberty County: Drilling & Exploration Co., Inc., et al 2 Boyt, Carrie Meche Sur. 25, A-760. IP 4,000 M.c.f. daily, estimated open flow, spray condensate, perforations 2,363-67 ft. TD 2,900 ft. (New pay in West Cottonwood field.)

Matagorda County: Gardner-Cyprus 1 Woodson, Block 42, John H. Wade Sur., A-98. IP 76,000 M.c.f. daily, open-flow potential, GCR 116 M.c.f. per barrel, 53.6°, perforations 6,599-6,607 ft. (upper Frio). TD 7,147 ft. (New field, or 1½-mile southeast extension of Midfields field.)

Nueces County: Superior Oil Co. 1 Wright, Section 47, Joaquin Lopez de Herria Grant, A-607. IP 494 M.c.f. daily and 4.64 BSPD, open flow, 61°, perforations 5,888-98 ft. TD 8,449 ft. (New field—Herra 25 sand.)

WEST CENTRAL TEXAS

Haskell County: Lester & Duffield, Inc., 2 Ballard, J. Spreck Sur. 2, GC&SF Sur., 1 mi. S Rochester. IP 120 BOPD, 16/64-in., 40°, TP 70 psi., GOR 350, conglomerate 5,790-95 ft. TD 5,826 ft.

W. B. Omohundro 1 Webb, Subd. 36, Red River CSL Sur., 2 mi. SE Rochester. IPP 168 BOPD, 37°, GOR 1,470, Strawn sand 4,814-34 ft. TD 5,034 ft.

Stonewall County: J. B. Schick Drilling Co. 1 Bryson, 118-D-H&TC, 3 mi. N Aspermont. IP 243 BOPD, 42°, TP 150 psi., GOR 620, conglomerate 6,072-88 ft. TD 6,141 ft.

Woodward & Co. and Dan Auld 1 McFarland, D. Martindale Sur. 1, A-417, 10 mi. NE Aspermont. IPP 132 BOPD, 38°, GOR 750, pay 5,930 ft. TD 6,000 ft.

NORTH TEXAS

Archer County: John F. O'Donohoe 2-A Miller, Blk. 5, Mangold Subd., Lazarus Ranch, McKinney & Williams Sur., N edge of Mankins. IP 84 BOPD, 39°, 12/64-in., GOR 400, TP 110 psi., Strawn pay 4,286 ft. TD 4,320 ft.

Clay County: Bridwell Oil Co. 16 Viola Myers, C. Thompson Sur., A-44, 4 mi. SW Bluegrove. IPP 46.42 BOPD, 41°, GOR 350, pay 4,649 ft. TD 4,666 ft.

Cooke County: Kay Kimball 1 Ussery, Blk. 76, Fannin CSL Sur., A-1248, 3 mi. N Callisburg. IPP 83 BOPD, 38° GOR 100, sand pay 2,696-2,704 ft. TD 2,975 ft.

Grayson County: Larson & Thomas 2 Clinton, J. L. Atchison Sur., A-21, 2½ mi. NW Sherman. IP 228 BOPD, 22/64-in., 39.4°, GOR 755, TP 280 psi., Cordell pay 8,940 ft. TD 9,797 ft.

Standard Oil Co. of Texas 1 Smith, J. H. Clark Sur., A-281, 4½ mi. N Sherman. IP 219 BOPD, 16/64-in., 39.7°, GOR 1690, TP 350 psi., Ordovician lime pay 10,145-67 ft. TD 11,309 ft.

NORTHWEST NEW MEXICO

Rio Arriba County: Southern Union Gas Co. 1 "L" Jicarrilla, SE NW SE 33-25n-5w. IP 315 M.c.f. of gas per day, Pictured Cliffs sand discovery, new gas field. TD 2,741 ft. Pictured Cliffs.

WEST TEXAS

Crane County: Tide Water Associated Oil Co. 1-B Barnsley, 34-B32-PSL, new pay in

Lea field. IP 140 BOPD, 24/64-in., TP 25 psi., GOR 645, 38°, San Andrews pay 3,075 ft. TD 8,501 ft.

Runnels County: Robert E. Morrison and G. M. Luhn 1 Webb, A. Lassassier Sur. 174, old well reworked for a new-pay discovery. IPP 22.84 BOPD, pay 2,964-68 ft. TD 4,116 ft.

MISSISSIPPI

Jones County: Central Oil Co. 1 Sanders et al, NE NW NW 5-9n-10w, IPP 70 BOPD (net), plus 2.2. per cent b.s. and w., 14.1°, Eutaw 5,590-5,600 ft. (preforations). TD 5,719 ft. (Extends and revives abandoned Sandersville field.)

SOUTH LOUISIANA

Lafourche Parish: Humble Oil & Refining Co. 2 Jones et al, 25-17s-22e. Shut-in gas well, no gage, perforations 10,768-76 ft. TD 11,800 ft. (New pay in Little Temple field.)

Plaquemines Parish: Continental Oil Co. 1 State Lease 2550, Block 56, West Delta area, Gulf of Mexico. IP 666 M.c.f. daily and 1.7 BSPD, 9/64-in., 52°, perforations 4,361-65 ft. TD 12,898 ft. (New offshore field.)

California Co. 1 State Lease 2589, Block 5, South Pass area, Gulf of Mexico. IP 120 BOPD, 9/64-in., 38.1°, perforations 9,079-90 ft. TD 11,000 ft. (New offshore field.)

WEST VIRGINIA

Jackson County: Grant district: D. D. Foster 1 Loyd Burdette, elevation 915 ft., 1,300,000 cu. ft. of gas, natural, rock pressure 1,650 psi., Corniferous lime 4,311 ft., Oriskany sand 4,417-19 ft., and 4,422-27 ft. TD 4,427 ft.

NORTH LOUISIANA

DeSoto Parish: McAlester Fuel Co. 1-A Blanche Story et al, 1¼ mile north of production, 17-12n-14w. IPP 13 BOPD, 36°, Paluxy 2,749-56 ft. TD 4,055 ft. (Outpost to Spider field.)

OKLAHOMA

Beaver County: Cities Service Oil Co. 1 Miles "B," SE SE NW 12-4n-24eCM. IPP 60 BOPD, Marmaton lime 5,666-90 ft., 42°. TD 6,945 ft.

Wagoner County: Larkin-Porter et al 1 Hurd, SE SE NW 14-19n-16e. IPP 7 BOPD, sand 451-70 ft., 38°. TD 472 ft.

KANSAS

Dickinson County: Augusta Oil Co. et al 1 Kandt, SE NW SE 20-16s-4e. IPP 25 BOPD, Mississippian 2,278-90 ft., 33°. TD 2,295 ft. (Opens Northwest Lost Springs pool).

Elk County: Franco-Central 1 Ware, NW NW NW 5-31s-9e. IPP 29 BOPD, Kansas City lime 1,665-68, 1,671-73 ft. TD 2,640 ft. (Opens Ware pool).

Ellis County: Cook & Galloway-Sunray Oil Corp. 1 Rajewski, SW SW NW 28-15s-17w. IPP 130 BOPD, Arbuckle 3,517-20 ft., 38.8°. TD 3,520 ft. (Opens Southeast Wheatland pool).

Graham County: R. W. Shields 1 Tremblay, NW NW NE 3-9s-21w. IPP 73 BOPD, conglomerate 3,667-72 ft., 24°. TD 3,755 ft. (Oil discovery).

Pawnee County: Cities Service Oil Co. et al 1 Dix, SW SW NW 21-21s-15w. IP 3,762 M.c.f. of gas per day, conglomerate 3,741-47 ft. TD 3,856 ft. (Gas discovery).

C.U. Bay 1 Fisher, NW NE NW 26-23s-17w. IPP 25 BOPD, 4,240-44 ft. TD 4,600 ft. (Opens West Carpenter pool).

CALIFORNIA

Fresno County: The Texas Co. 1 Burrel Ranch, NW NE 12-17s-18e, IPF 70 BOPD, 30° gravity, 12/64-in. choke, 52 per cent cut, 37 M.c.f. gas, perfs. 6,795-6,803 ft., TD 8,275 ft., plugged back 6,808 ft. (New field discovery 1½ miles southeast of Burrel field.)

Kern County: Richfield Oil Corp. 87 K.C.L.-G, SE SE 22-11n-20w, IPF 164 BOPD, 28/64-in. choke, 17.5° gravity, 30 M.c.f. gas, perfs. 3,599-3,717 ft., TD 11,064 ft., redrilled 9,001 ft., redrilled 3,720 ft. (New shallower pool discovery ¾ mile northeast of Wheeler Ridge field.)

COLORADO

Adams County, Muddy Creek: British-American Oil Producing Co. 1 "G" UPRR, NE NE SE 27-1s-59w. IPF 58 BOPD, "J" sand discovery, new field. TD 6,320 ft. Skull Creek.

Logan County: J. W. Braden Oil Co. and L. C. Jim Hoover, Sr. 1 Bracktenbach, C SE NW 26-8n-54w. IP 7,850 M.c.f. of gas per day, "J" sand discovery, new gas field. TD 5,135 ft. "J" sand.

British-American 1 "G" Monroe, Lot 1, 5-8n-53w. IPP 106 BOPD, "D" sand discovery, new field. TD 5,070 ft. Skull Creek.

WYOMING

Park County, Oregon Basin: The Texas Co. 1 State "D," NE SW NW Lot 60, 51n-101w. IPP 135 BOPD, Phosphoria discovery, new pay. TD 4,584 ft. Tensleep.

WESTERN CANADA

Seaboard-Canadian Superior 7-7 South Joffre, LSD 7, 7-38-25w4. Viking oil well. TD 6,923 ft.

Socony-Woodley Southern 19-14 Antelope Lake, LSD 14, 19-16-18w3. Blairmore gas well. TD 3,432 ft.

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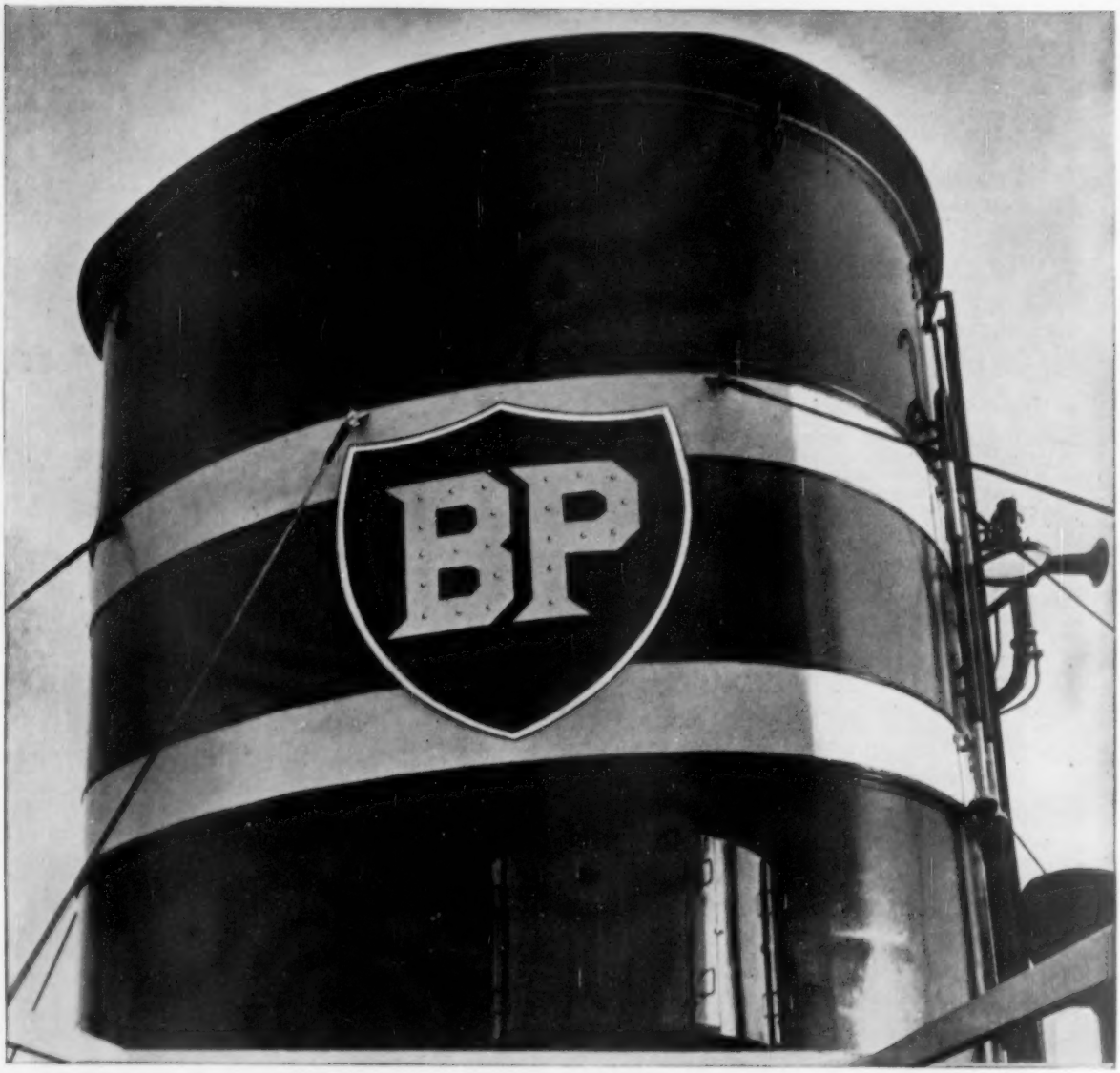


BP SHIPS THE OIL

The British Tanker Company, shipping subsidiary of The British Petroleum Company Limited, operates one of the world's largest tanker fleets, shipping crude oil and products to refineries and markets in many countries.

There are fourteen BP refineries in Great Britain, Aden, Australia, France, Belgium, Italy, Germany and Israel. The latest, at Kwinana in Western Australia, came on stream in February, 1955, more than three months ahead of schedule.

The British Petroleum Company distributes and markets oil products both direct and through various associated companies.

Its prospecting subsidiary, the D'Arcy Exploration Company, is interested in oil-bearing territories in many parts of the world.

The Company's main research establishments are at Sunbury in Middlesex and at Kirklington in Nottinghamshire.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

PERSONALS

Reeves Honored

Research Institute head is veteran Esso official

RESEARCH is to industry what a paratrooper unit is to the Army, says E. Duer Reeves, executive vice president of Esso Research & Engineering Co.

Reeves has just been elected president of the Industrial Research Institute, New York, a professional organization representing 140 of the nation's leading industrial research firms.

A veteran of 25 years with Esso Research, Reeves explains his paratropper comparison like this. Each individual in research is picked for the special training he has acquired. He is fully informed on the objective and then taught to operate as an integral part of the team. Once briefed, he makes his jump and is on his own. He is expected to carry out his duties while driving toward the common goal.

In assuming his honorary office at Industrial Research Institute, Reeves predicts that expenditures for industrial research will more than double during the next 10 years. Currently, about $3 billion is being spent in industrial laboratories by private companies and the U.S Government. An additional $1 billion is being spent by the U.S. in government laboratories.

Reeves points out that industrial research has become important to national defense and conservation of natural resources. He says major companies also can be expected to increase their research budgets because competition is becoming keener for the consumer's dollar.

Reeves for many years has been deeply interested in organization and administration of research as a special area of management. Associates say that in the process he has become a dynamic and effective administrator. He strives to build the human and physical resources of his company and at the same time pushes new ideas and developments. He is basically optimistic and enthusiastic and if a project looks good, he will back it to the hilt.

Reeves started his research career when he joined the Jersey Standard companies in 1930 shortly after he was graduated from Williams College. He was closely associated with development of fluid catalytic cracking, the widely used method for making high-octane gasoline. He has held his present title in the company since 1949.

He was married in 1932 to Elsie Kean of Baton Rouge. The couple has four children. This June when Reeves attends his 25th reunion at Williams, he also will attend commencement to see his oldest son receive a bachelor's degree.

Reeves likes swimming, baseball, and tennis and is especially fond of golf. He enjoys the challenge of playing new and different courses. He is a trustee of the First Presbyterian Church, Cranford, N. J., and he holds family memberships in the Echo Lake Country Club and Pine Valley Golf Club. He also is a member of the American Chemical Society, the Society of Automotive Engineers, the Armed Forces Chemical Society, Phi Beta Kappa, and other honorary and professional societies.

Reeves has an unusual combination of intellectual curiosity and warm human approach to business that helps open many important doors of research.

W. S. (Bill) McCabe, former geologist with Stanolind Oil & Gas Co., has resigned to open offices as a consulting geologist in Casper, Wyo. During 13 years with Stanolind, McCabe served as district geologist, division geologist, exploration superintendent, and regional geologist.

F. W. (Dick) Borden has been elected a vice president and manager of the company's West Coast district operations of Sunray Mid-Continent Oil Co. Borden joined the company in 1930 and served as a roustabout, pumper, gager, and field clerk until 1933, when he became a gasoline-plant operator. He later advanced through several responsible production jobs until he was named manager of the California district in May 1952.

David W. Harris, president of Universal Oil Products Co., was honored recently at a banquet in Chicago upon completion of 10 years as president of U.O.P.

Charles J. Wrightsman, prominent Fort Worth independent producer and early-day Oklahoma lawyer, will receive an honorary doctor of laws degree from Georgetown University, Washington, this week. Wrightsman is an 1890 Georgetown graduate.

C. C. BOOK

C. C. Book has been promoted by Republic Natural Gas Co. from assistant general superintendent to general superintendent of drilling and production at the Dallas headquarters. Book joined Republic Natural in 1947 and had been assistant general superintendent of drilling and production for the past 4 years. Before joining Republic, he worked for Macmillan Petroleum Corp., Root Petroleum Co., Tide Water Associated Oil Co., Lion Oil Co., and was a partner in F. A. Book Drilling Co. **G. W. Atchley,** formerly assistant superintendent of Republic Natural's Hugoton, Kans., district, has been transferred to Dallas on special assignment to assist the operations department in supervising drilling and production activities in the field. **S. S. McCord, Jr.,** has been promoted from superintendent of the South Texas district at Corpus Christi to drilling and production manager of the Louisiana division at New Orleans. **R. L. Prichard** also is going to New Orleans as drilling superintendent of the Louisiana division from a position as drilling superintendent in North Louisiana. **J. W. Hopson** has been promoted from assistant superintendent to superintendent of the South Texas district at Corpus Christi, replacing McCord. **R. M. Albers** has been promoted from field engineer in the Ellinwood, Kans., district to petroleum

G. W. ATCHLEY

S. S. McCORD

PERSONALS

engineer at Dallas. **J. W. Ermey** has been transferred from Pauls Valley in the Oklahoma district to Crowley in the Louisiana division as production foreman.

Robert L. Alkire, chief of the oil and gas section of the Ohio division of Geological Survey, has resigned to open geological offices in Columbus, Ohio.

Elmer F. E. Schmidt, former vice president and general manager of Lone Star Gas Co., has been elected president of Overland Oil, Inc., Denver oil and uranium company. **Winfield Morten,** president of Overland since its organization, was elected chairman of the board. **John O. Hayden** was re-elected vice president and a member of the board.

Clyde Johnson has been named vice president and manager of Delta Drilling Co.'s two Venezuelan subsidiaries, Per-

C. JOHNSON

G. STETSON

foraciones Delta, C.A. and Perforaciones Guarico, C.A. Johnson, a veteran of South American drilling operations, served with Loffland Brothers Co. of Venezuela before joining Delta. **George Stetson** has been appointed chief engineer of Delta Gulf Drilling Co. Before joining Delta Gulf, Stetson had been associated with Offshore Co., Baton Rouge.

Edmond C. Breene has been named executive representative and general manager of International Petroleum Co., Ltd., in Venezuela. Breene succeeds **Joseph A. Holmes,** who has retired. Breene joined the firm in 1934 as a petroleum engineer at Talara, Peru, where he later became division manager. He had been serving as assistant producing advisor in the Coral Gables, Fla., office until his appointment in Venezuela. Holmes joined International in 1946 as executive representative after having served with Mid-West Refining Co., Southern Crude Oil Producing Co., Pan American Petroleum & Transport Co., Lago Petroleum Corp., and Creole Petroleum Corp.

President of Jersey Affiliate Honored

Serge F. Scheer, left, president of Esso Standard, S.A. Francaise, had his visit to the United States temporarily interrupted by a cablegram from France informing him that he had been named an officer in the French Legion of Honor. Eugene Holman, chairman of the board of Standard Oil Co. N.J.), was on hand to congratulate Scheer. The president of the French company was honored for his work in developing crude-oil production in France. Scheer, who has served with Esso Francaise for 29 years, guided the program which developed the Parentis area, where production is expected to reach 20,000 bbl. daily by the end of the year.

William Naden has been elected executive vice president of Esso Standard Oil Co. A director of Esso Standard since 1946 and a vice president since 1950, Naden succeeds **Marion W. Boyer,** who has been elected a director of Standard Oil Co. (N. J.). Naden joined Esso 28 years ago as a chemist. He has served as general superintendent of the company's refineries at Baltimore and Everett, Mass.

J. W. W. Whitney, Jr., has been named chief production engineer by Helmerich & Payne, Inc., operators of White Eagle Oil Co.'s producing properties. Whitney has served the past 6 years as district petroleum engineer for Magnolia Petroleum Co. in Electra, Tex.

Alfred Moskowitz has been promoted to senior mechanical engineer in the design department of the engineering division at the Baytown, Tex., refinery of Humble Oil & Refining Co. He joined the company in 1943. **W. O. Webber** has been promoted to technical specialist in the technical service division by Humble at Baytown. Webber joined the firm in 1938.

W. W. Hawthorne, district geophysicist with Atlantic Regining Co. at Casper, Wyo., has been transferred to Shawnee, Okla.

I. H. Hughes has been named assistant to **R. E. (Ed) Foss,** vice president and general manager of Sunray Mid-Continent Oil Co. Hughes was formerly assistant to **Albert E. Pierce,** who retired as vice president in charge of production of Mid-Continent Petroleum Corp. on May 1. Sunray Oil Co. and Mid-Continent merged May 16. Other changes in the new company's production field operations are **E. F. Patrick,** formerly superintendent in West Texas for Mid-Continent, named North and West Texas district superintendent at Midland; **A. E. (Roy) Hoffman,** former district superintendent for Sunray in this district, named superintendent of the Louisiana-Arkansas-Texas (tri-state) district with headquarters at Lewisville, Ark.; **E. S. Pierce,** named district engineer at Midland; **F. M. McDaniel,** former tri-state district superintendent for Sunray, named assistant district superintendent at Corpus Christi, Tex.; **Fred S. Goddard,** former South Texas district superintendent for Sunray, transferred to the general offices in Tulsa to be assistant to the superintendent of production; **V. L. (Fred) Smith,** named Oklahoma superintendent; and **Roy E. Wingo,** appointed assistant district superintendent for Oklahoma.

PERSONALS

Donald L. Henderson, petroleum engineer at Forsan, Tex., with Continental Oil Co., has resigned to join Murray Petroleum Co. at San Angelo, Tex.

John W. LeSassier has acquired the interest of the late E. Russell Lloyd in the firm of Lloyd, Penn & Hills, consulting geologists at Midland, Tex. The company will be known as Lloyd, Penn, Hills & LeSassier.

J. French Robinson, president of Consolidated Natural Gas Co. since 1951 and a director since 1943, has been elected chairman of the board. **James Comerford,** executive vice president, was named president.

P. C. Spencer, chairman of the board of directors of the American Petroleum Institute, and **Frank M. Porter,** president of the A.P.I., are attending the Fourth World Petroleum Congress in Rome. Spencer, who is president of Sinclair Oil Corp., New York, and Porter, who heads Fain-Porter Drilling Co., Oklahoma City, will participate in the Congress as industry representatives to the Committee of Honor.

Hal F. Nabors has been promoted to assistant general manager of Continental Oil Co.'s central region with

HAL F. NABORS

E. A. AUSTIN

headquarters in Oklahoma City. Before his promotion, Nabors was southern region production manager for Conoco at Houston. Nabors has served in the production department of Conoco for 21 years in New Mexico, Wyoming, Colorado, and Texas. He was a district production superintendent in Texas and Wyoming before his promotion in 1949 to assistant manager of the southern region production department. He was named manager of the department in 1952. **E. A. Austin,** assistant production manager of the southern region, has been promoted to manager to succeed Nabors. Austin joined Conoco in 1939 as a roustabout at Tepetate, La. He was named district petroleum engineer at Rincon, Tex., in 1946 and became division petroleum engineer at Tepetate the following year. He was transferred to Houston as southern regional petroleum engineer in 1948 and promoted to assistant production manager in 1952.

H. H. Colleton, district superintendent with Service Pipe Line Co. at Monahans, Tex., has been transferred to Lubbock, Tex.

Graham B. Moody, retired chief petroleum reserves engineer of Standard Oil Co. of California, has opened offices in San Francisco and Berkeley as a petroleum consultant. Moody retired from Standard last year.

R. L. Adams, former assistant division superintendent at Midland, Tex., has been promoted to division superintendent of the newly created New Mexico division by Continental Oil Co. Adams, who will headquarter in Roswell, joined Conoco in 1946 as a roustabout in New Mexico. He was named district petroleum engineer at Borger, Tex., in 1948 and in 1950 was transferred to Wichita Falls, Tex., as assistant district superintendent. He served briefly as superintendent of the North Oklahoma production district before he was promoted to assistant division superintendent at Midland.

W. R. Apperman, former exploration manager of Altamont Oil Syndicate at Malta, Mont., and Casper, Wyo., has resigned to become an independent operator with headquarters at Lander, Wyo.

Charles C. Ingram, district operations superintendent with Oklahoma Natural Gas Co. at Oklahoma City, has been promoted to vice president of the land and geological department and transferred to Tulsa.

A. G. Smith has been promoted from assistant manager of thermal cracking at Shell Oil Co.'s Wilmington, Calif., refinery to manager of the effluent-control department. Other changes include: **J. L. Buhler,** promoted from the alkylation department to assistant manager of thermal cracking; **S. J. Artese,** senior engineer in the inspection department, transferred to the company's New York office; and **A. N. Sims,** former chemical engineer at Shell Development Co.'s Emeryville, Calif., offices, named chemical engineer at the refinery.

Cecil V. Hagan, Houston oil man and consulting geologist, was elected chairman of the board of Gulf Coast Leaseholds, Inc., at the firm's recent annual meeting. **Morton Downey,** director of General Aniline & Film Corp. and Desogel Chemical Co., was elected to the board of directors.

DEATHS

William F. Barrett, 69, former chairman of the board of Carbide & Carbon Chemicals Corp., died recently in New York.

Donald Kenneth McLennan, 70, West Coast independent oil operator, died recently at his home in Bakersfield, Calif.

Dr. J. A. Allan, 70, former head of the University of Alberta geology department, died recently at his home in Edmonton. Allan, who retired from the university 5 years ago, was active in province geological circles.

Ralph Hochstetter, 85, president of Cliff Petroleum Co., pioneer oil producer in several fields, died May 27 in Buffalo.

William G. Culp, 89, retired Tulsa oil driller, died recently at his home in Barnsdall, Okla.

Charles Donovan Martin, 59, retired oil operator, died recently in a Tulsa hospital after a long illness. He operated in Oklahoma, Texas, and Colorado.

Claude Olde, 67, assistant superintendent of the Lucien Unit natural-gasoline plant near Perry, Okla., died recently in a Perry hospital after a 4-month illness. Olde retired from Shell Oil Co. in 1950 after 30 years of service with the firm. He joined Gasoline Plant Management Co. when the firm took over operation of the Lucien unit from Shell.

Allen S. Hicks, Hydril Co. production engineer, died recently in Los Angeles. He joined Hydril in 1930 as a shop hand and later represented the firm in Oklahoma, Texas, and in various foreign sales.

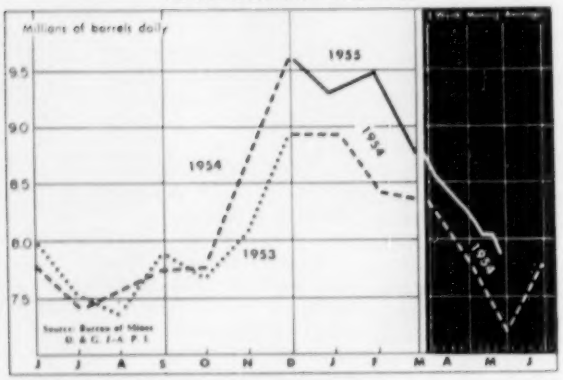
E. R. Varner, Worland, Wyo., oil man, died recently in Memphis, Tenn. He was field foreman for the California Co. at the Nieber Dome field. He had been with the company for 9 years.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,666,325	DOWN	31,750	UP	193,825
Crude stocks	279,018,000	UP	810,000	UP	3,109,000
Completions	1,191	DOWN	89	UP	199
Refinery runs	7,483,000	UP	154,000	UP	463,000
Gasoline stocks	169,373,000	DOWN	1,304,000	DOWN	3,482,000
Distillate stocks	80,204,000	UP	4,095,000	UP	8,980,000
Four-product stocks	318,953,000	UP	4,637,000	UP	5,025,000
Total imports	1,384,900	UP	337,100	UP	282,800

TOTAL DEMAND—ALL OILS



Too Much Production, Too Little Demand Have Created Soft Distillate Markets

SECOND-QUARTER distillate sales in the Mid-Continent and North Central areas have been below last year, but refinery production is up. Gulf-East Coast demand shows a gain over last year but the increase is overshadowed by the abnormal increase in distillate production.

Stocks of distillate fuel in the combined Mid-Continent and North Central refining districts amounted to 15,716,000 bbl. on April 1 of this year. By May 20, stocks had climbed to 22,883,000 bbl. for a gain of 7,167,000 bbl. Suppliers in these districts ran 400,000 bbl. more distillate to storage each week for the 7-week period than for the same period last year.

In the accompanying table, note that inland demand for the 7-week period averaged only 236,000 bbl. daily this year compared with 263,000 bbl. daily last year. On the other hand, production was up to 382,000 bbl. daily from 352,000 bbl. daily last year.

For the combined Gulf Coast-East Coast districts, demand was up 7.9 per cent from 622,000 bbl. daily to 671,000 bbl. daily, but refinery production of distillate gained 16.6 per cent from 691,000 bbl. daily last year to 806,000 bbl. daily this year.

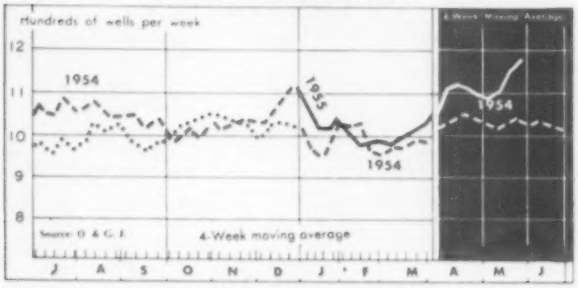
Most of the Gulf-East Coast gain in production was on the Gulf Coast where the average was 564,000 bbl. daily this year compared with 468,000 bbl. daily last year. East Coast production was up only 19,000 bbl. daily. Most of the Gulf-East Coast stock gain for the 7-week period this year was on the Gulf Coast. Last year it was on the East Coast.

The combination of increased production and slow sales has put pressure on distillate markets, both inland and coastal.

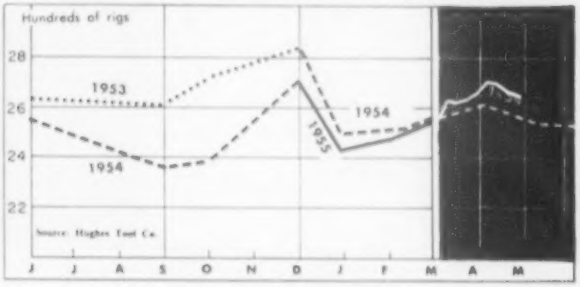
DISTILLATE TRENDS SINCE END OF MARCH
(Thousands of barrels)

	Ill.-Ind. Okla.-Kans.	East Coast	Gulf Coast	Gulf-East Coast
1955—				
Stocks:				
April 1	15,716	22,462	8,670	31,132
May 20	22,883	25,102	12,664	37,766
Change	7,167	2,640	3,994	6,634
Production:				
7-week total	18,728	11,858	27,655	39,513
Daily average	382	242	564	806
Indicated demand:				
7-week total	11,561	9,218	23,661	32,879
Daily average	236	188	483	671
1954—				
Stocks:				
April 3	15,195	20,111	8,857	28,968
May 22	19,526	22,392	9,946	32,338
Change	4,331	2,281	1,089	3,370
Production:				
7-week total	17,238	10,927	22,954	33,881
Daily average	352	223	468	691
Indicated demand:				
7-week total	12,907	8,646	21,865	30,511
Daily average	263	176	446	622

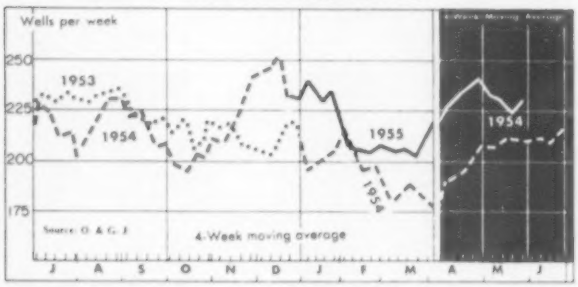
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	5-30-55	Change from 5-23-55	Change from 5-31-54
Gulf Coast	567	—2	—14
N. and W. Texas-New Mexico	872	—4	83
Arkansas-N. Louisiana-E. Texas	170	—1	0
Oklahoma	298	—18	—35
Kansas-S. Nebraska	181	5	34
Illinois-Eastern	173	11	28
Rocky Mountain	244	12	—19
Pacific Coast	141	—10	—2
Total United States	2,646	—7	75
Western Canada	128	—1	7

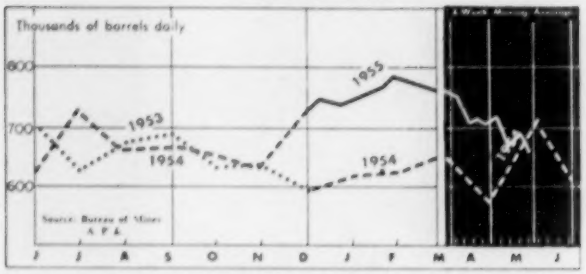
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 28, 1955

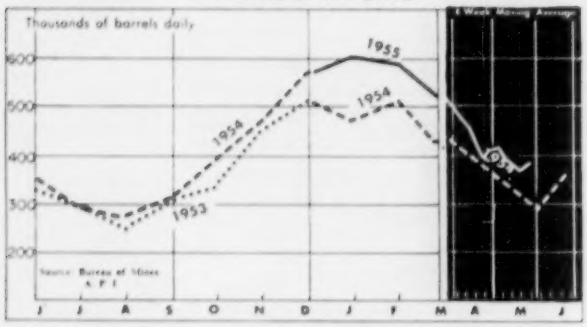
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	38	44	0	0	0	0	0	0	0	0	36	36
Arkansas	21	12	0	9	64,429	287	240	1	0	0	4	5	16	0	0	72	88
California	39	27	1	11	195,195	1,052	1,020	2	0	0	9	11	17	0	3	162	182
Colorado	31	13	1	17	166,761	549	520	2	0	1	12	15	21	0	14	270	305
Illinois	62	36	0	26	151,002	1,442	1,090	1	0	0	5	6	26	0	1	220	247
Indiana	35	2	2	31	47,131	308	340	0	0	0	24	24	7	0	0	143	150
Kansas	108	58	9	41	372,920	2,069	1,788	6	0	1	19	26	56	1	17	308	382
Kentucky	23	10	4	9	35,137	498	442	0	0	0	4	4	16	0	5	77	98
Louisiana	144	105	6	33	671,686	1,608	1,289	3	0	1	11	15	47	37	11	159	254
North	96	77	1	18	209,292	857	673	1	0	0	3	4	9	3	1	62	75
South	48	28	5	15	462,394	751	616	2	0	1	8	11	38	34	10	97	179
Michigan	13	5	1	7	43,987	205	230	1	0	0	5	6	6	0	0	78	84
Mississippi	8	3	0	5	56,859	196	147	0	0	0	2	2	4	0	0	70	74
Montana	8	3	2	3	32,634	131	104	0	0	0	1	1	2	0	1	36	39
Nebraska	20	7	0	13	114,747	280	134	0	0	0	9	9	16	0	0	109	125
New Mexico	32	16	8	8	135,291	581	432	0	0	1	0	1	16	1	4	42	63
Northwest	8	0	6	2	19,967	160	126	0	0	1	0	1	2	0	4	12	18
Southeast	24	16	2	6	115,324	421	306	0	0	0	0	0	14	1	0	30	45
North Dakota	14	11	0	3	91,869	92	94	0	0	0	2	2	0	0	0	14	14
Ohio	31	19	3	9	57,349	439	453	0	0	0	2	2	1	0	2	12	15
Oklahoma	150	76	5	*69	462,937	3,501	3,707	2	0	0	15	17	53	7	16	262	338
Pennsylvania-New York	29	12	5	†12	53,767	682	1,000	0	0	0	0	0	0	0	5	3	8
Texas	392	242	9	141	1,752,595	7,921	7,283	13	4	3	85	105	302	46	57	1,632	2,037
Southwest (1 & 4)	59	36	3	20	238,927	1,235	1,015	0	1	2	13	16	38	11	19	312	380
Gulf Coast (2 & 3)	61	34	2	25	392,758	1,047	1,047	3	3	1	16	23	36	28	21	260	345
East (5 & 6)	19	8	1	10	96,623	385	375	0	0	0	7	7	12	3	1	120	136
North Central (7-B & 9)	151	87	2	62	515,554	2,847	2,789	9	0	0	31	40	153	0	4	635	792
West (7-C & 8)	86	64	0	22	451,305	2,000	1,683	1	0	0	16	17	60	1	6	295	362
Panhandle (10)	16	13	1	2	57,428	407	374	0	0	0	2	2	3	3	6	10	22
Utah	1	0	0	1	2,213	28	27	0	0	0	1	1	2	0	2	16	20
West Virginia	8	0	6	2	28,683	238	218	0	0	1	1	2	0	0	6	10	16
Wyoming	22	9	0	13	110,613	322	571	1	0	0	6	7	8	0	3	65	76
Miscellaneous	0	0	0	0	0	15	76	0	0	0	0	0	0	0	0	12	12
Total United States	**1,191**	666	62	463	4,647,895	22,482	21,249	32	4	8	217	**261**	616	92	148	3,808	4,663
Total previous week	1,280	722	101	457	4,901,671			33	6	13	179	231	584	88	139	3,591	4,402
Total May 29, 1954	992	567	81	344	3,855,646			42	6	9	136	193	570	62	135	3,520	4,287
Western Canada	23	18	0	5	103,912												

Service wells included: *5, †11.

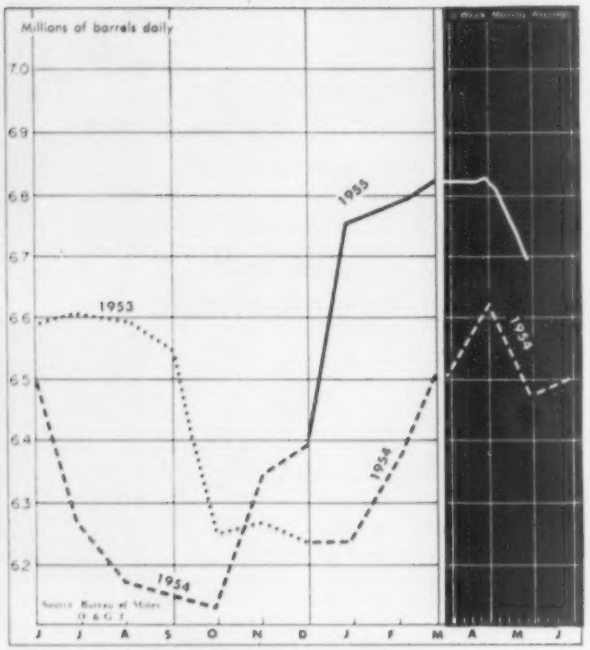
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE OIL PRODUCTION

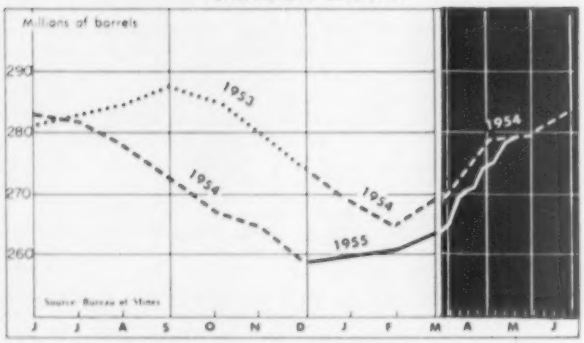


DAILY AVERAGE PRODUCTION FOR WEEK

	May 28 Crude oil	May 28 Lease condensate	May 28 Total	May 21 total
Alabama	3,700		3,700	3,800
Arkansas	73,550	500	74,050	72,850
California	975,800		975,800	977,200
Colorado	144,400		144,400	141,600
Eastern	46,500		46,500	46,500
Florida	1,350		1,350	1,350
Illinois	220,100		220,100	221,800
Indiana	28,800		28,800	28,600
Kansas	309,100		309,100	311,800
Kentucky	40,200		40,200	39,700
Louisiana	676,700	53,000	729,700	727,350
North	112,700	3,000	115,700	113,350
South	564,000	50,000	614,000	614,000
Michigan	29,700		29,700	34,500
Mississippi	91,975	4,700	96,675	96,675
Montana	45,100		45,100	45,600
Nebraska	30,100		30,100	29,700
New Mexico	227,700	4,150	231,850	231,650
North Dakota	24,700		24,700	26,400
Oklahoma	533,100		533,100	555,400
Texas	2,761,000	50,300	2,811,300	2,811,300
Dist. 1	53,600	600	54,200	54,200
Dist. 2	139,700	8,200	147,900	147,900
Dist. 3	427,000	22,800	449,800	449,800
Dist. 4	232,500	5,475	237,975	237,975
Dist. 5	45,500	475	45,975	45,975
Dist. 6	118,000	5,450	123,450	123,450
East Texas Field	213,000		213,000	213,000
Dist. 7-B	139,000	50	139,050	139,050
Dist. 7-C	185,400	4,350	189,750	189,750
Dist. 8	912,800	2,000	914,800	914,800
Dist. 9	207,000	775	207,775	207,775
Dist. 10	87,500	125	87,625	87,625
Utah	6,000		6,000	6,200
Wyoming	283,800		283,800	287,700
Others	‡300		‡300	400
Total U.S.	6,553,675	112,650	**6,666,325**	6,698,075
Change from prev. week, down			**31,750**	
Canada	†348,475		†348,475	‡347,425
Total U.S. production January 1-May 28				999,118,175 bbl.
Same period last year (crude plus cond.)				*953,374,510 bbl.

*Includes 15,306,125 bbl. condensate. †Week ended previous Monday. ‡S.D. 100, Nev. 200.

CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

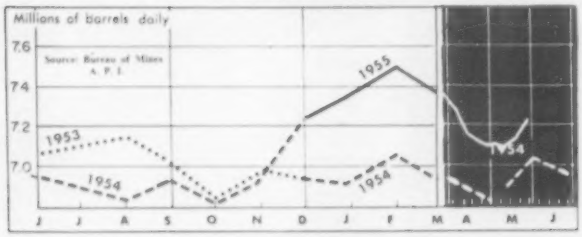
(Thousands of barrels)

	May 21, '55	May 14, '55	May 22, '54
Pennsylvania Grade	2,873	2,894	3,279
Other Appalachian	2,091	1,840	1,938
Illinois, Indiana, Michigan	12,996	12,241	12,412
Nebraska, North Dakota	2,336	2,325	(‡)
Kansas	8,826	8,952	10,022
Oklahoma	24,836	24,614	27,412
Arkansas	2,922	2,791	3,233
Louisiana	16,731	16,462	16,196
North	2,654	2,650	2,505
South	14,077	13,812	13,691
Mississippi	2,887	3,019	3,284
New Mexico	8,923	9,013	6,868
Texas	128,631	128,735	128,616
East Texas proper	10,258	10,392	11,973
West Texas	56,410	56,449	55,986
Texas Gulf	26,360	25,951	27,303
Other Texas	35,603	35,943	33,354
Wyoming	15,732	15,735	14,509
Other Rocky Mountain	5,340	5,212	4,126
California	31,683	31,696	32,787
Foreign	†12,211	12,679	11,227
Total	279,018	278,208	275,909

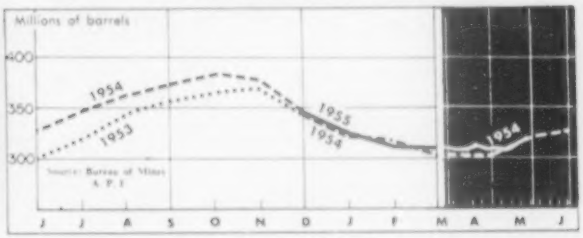
*Bureau of Mines. †Includes 2,766,000 bbl. in California. ‡Included with Kansas.

CURRENT DATA ON RUNS AND PRODUCTION ARE 4-WEEK AVERAGES

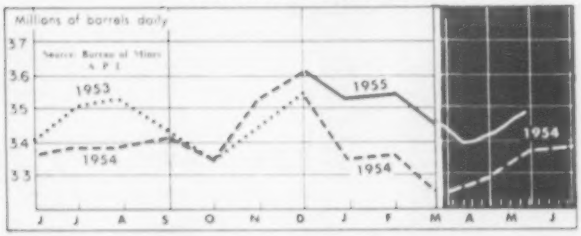
REFINERY RUNS



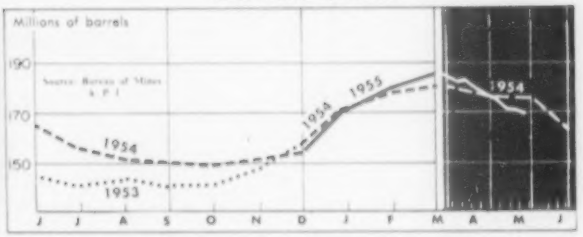
FOUR-PRODUCT STOCKS



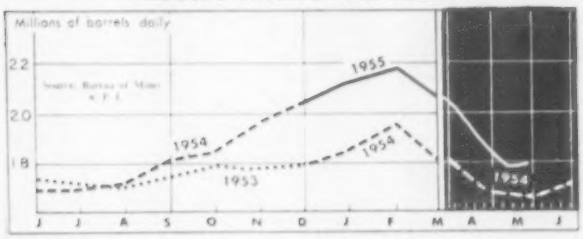
GASOLINE PRODUCTION



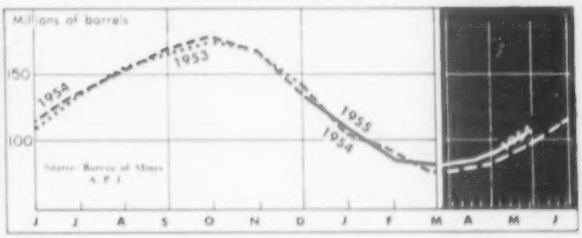
GASOLINE STOCKS



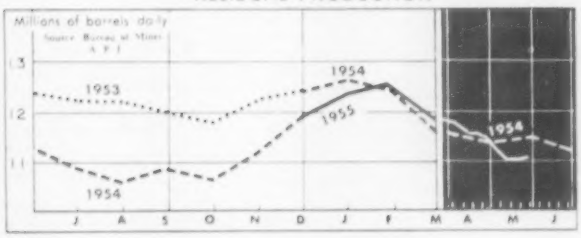
MIDDLE-DISTILLATE PRODUCTION



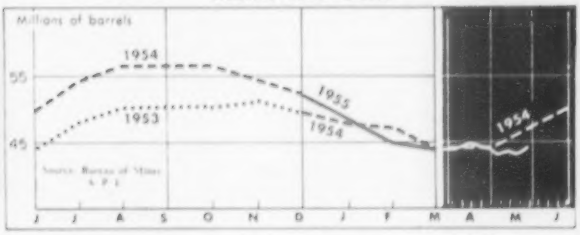
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



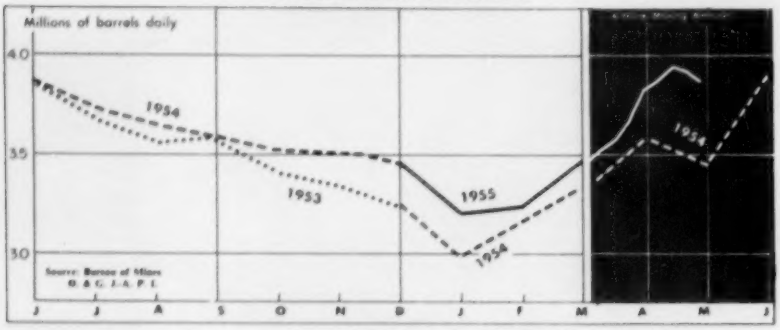
A. P. I. REFINERY REPORT, MAY 27

(Thousands of barrels)

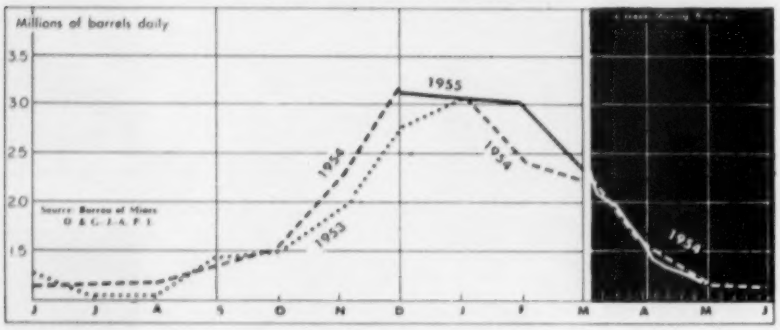
District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1954—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,115	415.6	31.0	243.3	176.0	36,979	10,616	26,536	8,495	1,038	412.8	28.9	216.9	206.7
Appalachian:														
District 1	77	29.1	0.6	15.7	3.7	4,640	473	1,801	327	106	47.2	3.6	22.6	7.8
District 2	100	53.1	4.3	17.1	12.0	2,556	300	659	222	82	48.5	4.2	10.6	10.4
Ind., Ill., Ky.	1,372	686.3	73.6	241.9	188.3	34,736	5,757	15,056	3,912	1,299	658.3	69.0	234.1	161.1
Okla., Kans., Mo.	651	356.4	16.1	155.6	31.3	16,120	1,300	8,799	809	617	334.8	18.3	126.9	43.3
Inland Texas	260	191.6	9.0	46.3	22.0	6,351	382	1,347	1,271	243	177.9	9.6	43.3	26.8
Texas Gulf Coast	1,851	831.0	108.1	394.1	254.0	23,833	3,052	9,079	4,143	1,674	805.9	98.1	345.6	216.3
La. Gulf Coast	653	328.4	49.8	177.1	43.2	10,770	1,963	4,605	1,495	567	281.7	50.4	139.9	46.1
N. La. and Ark.	88	33.7	7.9	20.4	5.0	3,893	821	1,569	69	88	36.0	7.7	20.5	7.3
Rocky Mountain:														
New Mexico	20	11.6	1.0	3.0	2.7	209		81	31	18	11.7	0.4	3.2	2.4
Other Rocky Mtn.	242	110.0	3.9	56.9	39.1	7,300	207	2,015	731	247	115.9	3.5	55.1	34.7
California	1,054	477.3	8.4	162.6	375.6	21,986	349	8,657	22,651	1,059	446.1	7.9	153.3	384.9
May 27, 1955	7,483	3,524.1	313.7	1,534.0	1,152.9	169,373	25,220	80,204	44,156	7,038	3,376.8	301.6	1,372.0	1,147.8
May 20, 1955	7,329	3,507.4	309.3	1,508.1	1,154.9	170,677	24,144	76,109	43,386					
May 28, 1954	7,020	3,273.4	333.7	1,351.3	1,184.7	172,855	23,416	71,224	46,433					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

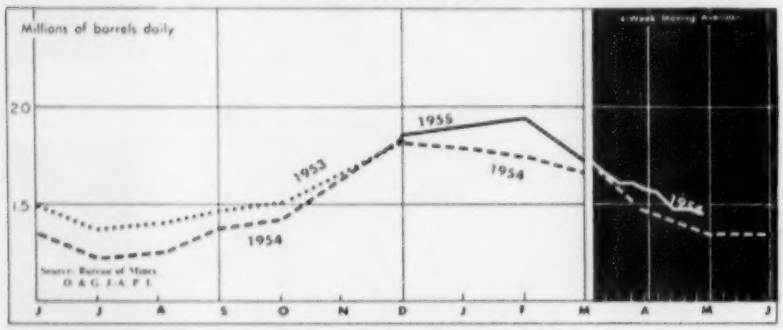
TOTAL GASOLINE DEMAND



TOTAL MIDDLE DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of June 1, 1955. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.75-11.25	11.25-12	10.25-10.75
Premium gasoline	12-12.5	13-13.75	11.50-12
42-44 w.w. kerosine	9.375-9.625	10.05	8.5-8.75
No. 2 straw fuel oil	8.625-8.875	9.3	8.0-8.25
No. 6 residual	$1.65-1.75	$2.35-2.45	$2.00-2.05

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	4.5	4.0	4.25
Grade 18-55	5.4	4.9	5.15

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• Sharp increases in distillate inventories have put pressure on light-fuel markets on the Gulf Coast and in the Mid-Continent. Residual is tight in the same areas with the low spot quotation up slightly on the Gulf Coast. Reports indicate some improvement in gasoline markets on the Mississippi River. High-octane gasoline prices are firm on the Gulf Coast.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 5-27-55	3,430	3,869
March 1955	3,460	3,408
April 1954	3,298	3,547
May 1954	3,377	3,463
Middle distillate:		
Four weeks ended 5-27-55	1,791	1,204
March 1955	2,060	2,297
April 1954	1,696	1,592
May 1954	1,674	1,167
Residual fuel:		
Four weeks ended 5-27-55	1,113	1,468
March 1955	1,185	1,749
April 1954	1,141	1,479
May 1954	1,148	1,342

SUPPLY AND DEMAND*

(Thousands of barrels daily)

	Mar. 1955	Feb. 1955	Mar. 1954
Domestic demand	**8,528**	**9,202**	**8,044**
Gasoline	3,409	3,159	3,276
Kerosine	353	536	419
Distillate	1,879	2,447	1,744
Residual	1,661	1,835	1,574
Jet fuel	164	156	120
Lubricants	118	105	116
L.P.G.	369	452	321
Other products	551	474	446
Crude loss	24	39	28
Exports	**331**	**366**	**312**
Gasoline	78	83	55
Kerosine	8	16	20
Distillate	57	38	53
Residual	89	121	90
Jet fuel			
Lubricants	40	41	34
L.P.G.	13	13	13
Other products	21	19	19
Crude	25	35	28
Total demand	**8,859**	**9,568**	**8,356**
Gasoline	3,487	3,242	3,331
Kerosine	361	552	439
Distillate	1,936	2,485	1,797
Residual	1,750	1,956	1,664
Jet fuel	164	156	120
Lubricants	158	145	150
L.P.G.	382	465	334
Other products	572	493	465
Crude exp. and loss	49	74	56
Stock change	**68**	**—602**	**— 87**
Crude	187	— 55	161
Products	—119	—547	—248
New supply	**8,927**	**8,966**	**8,269**
Imports	**1,319**	**1,378**	**1,079**
Crude	742	751	653
Products	577	627	426
Production	**7,608**	**7,588**	**7,190**
Crude	6,886	6,836	6,507
Nat. gasoline, etc.	722	752	683
Runs to stills	**7,374**	**7,549**	**7,374**

*Bureau of Mines.

(The schedule of selected crude prices appeared on page 156 of May 30 issue and will be printed again next week.)

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FOR SALE EQUIPMENT

FOR SALE: ENGINE—165 Hp. Climax Model R81, maximum continuous Hp. rating 126. Herndon Drilling Company, 421 Mayo Building, Tulsa. Phone 4-9700.

CORE DRILLS, SPUDDERS, ROTARIES: New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

FOR SALE: 1—Beaird—Ingersoll-Rand packaged Compressor Plant, Type 6-JVG (165 H.P.) Heavy Duty, direct connected, 4-cycle, gas engine driven, single stage equipped with 3—4¼ x 9 compressor cylinders, three hand operated fixed volume pockets, two hand operated valve lifters, 20" O.D. 500# W.P. intake scrubber, air starting equipment and controls for automatic operation. Designed for intake pressure range 100#-250#, discharge pressure range 500#-600#. Delivery 3,480 MCF per day at 250# intake, 550# discharge. This plant has been in use less than 30 days and is located near Palestine, Texas. Box H-616, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE
NEW 24" and 30" LINE PIPE

22,750'—24" O.D., 71.25# Electricweld Grade X-52, 40' DRL. Ends Beveled. Located: Pennsylvania and New York.

3,500'—30" O.D., 99.08# Electricweld Grade X-52, Range 2, Ends Beveled. Located: Tennessee.

Priced Low—Prompt Shipment—Present Location

MID-STATES PIPE & SUPPLY CO.
Ph. 2-9128 Tulsa, Okla.

USED EQUIPMENT

#527—Franks Model 44-TM, Single Drum, Truck Mounted Servicing Unit, 8x10x50' Single Pole Mast, Mounted on FWD Truck.

#536—Franks Model E.T. Single Drum Servicing Unit, 8x10x62' Single Pole Mast, Mounted on 1941 R8-F International Truck.

#526—Franks Super East Texas Double Clutch, Single Drum, Mounted upon K5-11 International Truck. No Mast.

#541—Franks Model ET Single Drum with 8x10x62-ft. Mast, Mounted upon 1948 Model K8 International Truck.

#517—Type 3 O.C.S. Servicing Unit mounted on 1942 Mack Truck. Located Odessa, Texas.

#525—50/60 Ideco Skid Servicing Unit. Double Pole Mast. Mounted on International Tandem Truck.

#533—Cardwell KL Double Drum Spudder with 60 ft. derrick.

Write, Wire or Call

FRANKS MFG. CORPORATION
SUBSIDIARY OF CABOT SHOPS, INC.
BOX 3218, WHITTIER STATION
TULSA, OKLAHOMA

FOR SALE EQUIPMENT

FOR SALE: Medium and small rotary rigs ready to work, priced right for sale. For further information contact Box H-778, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—1—1600 bbls. and 1—1000 bbls. red wood National 3" stave tanks at a bargain located near Wichita Falls, Texas. 1110 City Natl. Bldg. Ph. 2-7889, Wichita Falls, Texas.

FOR SALE: Equipment—24L Bucyrus-Erie spudder complete with tools, pipe and all incidental equipment. Box H-834, The Oil and Gas Journal, Tulsa, Oklahoma.

LIQUIDATION

5—600 HP IR Type KVG Gas Engine Driven 2 Stage Compressors (1942).

1—660 HP IR Type KVG Gas Engine Driven 2 Stage Compressor (1952).

$50,000 New Spare Parts for Above.

2—IR Starting Air Compressors, Model 25c, Type 40, 265#, 67.6 cfm.

LIQUIDATION LEVELLAND, TEX.

TOWERS: 6'x56' chrome-lined (1951) 6'6"x65', 6'x27', 5'x27', 42"x49', 30"x38'.
HEAT EXCHANGERS: (2) 800 sq. ft. (675# 800° F.) Steel.
VESSELS: 3'10"x38', 325#, 950° F.; 5'3"x38'6" (90# 845° F.) chrome lined.
PUMPS: BJ5-St. ni.-chr. pump, 2100' hd., 400 gpm.; IR 15x7x14 steam driven comp.
MISCELL.: Steel, chrome, pipe, valves and fittings, etc. NEW.

AT OTHER LOCATIONS

10—1500, 1000, 430, 360 sq. ft. Steel Ht. Exchangers.
4—2400, 740, 470, 424 sq. ft. Adm. Ht. Exchangers.
6—325# Vessels 10'x35', 7'x30', 4'x40'.
3—150# Vessels, 10'x20', 8'x16', 6'x20'.
4—Centrifugal Pumps, 2000 gpm. 90' hd., 60 gpm. 460' hd., motor and turb. driven.

ATMOSPHERIC HEAT EXCHANGERS

8—715 sq. ft., 850 psig, 550° F., S.S.
6—470 sq. ft. 850 psig, 550° F., S.S.
13—715 sq. ft. 125 psig, 300° F. S.S.
6—715 sq. ft. Admiralty 125 psig, 300° F.

WIRE! 'PHONE! WRITE!

Full Details on Request

BRILL EQUIPMENT COMPANY
4101 San Jacinto St., Houston 4, Texas, Locust 1351
Or
2401 Third Ave., New York 51, N. Y., Cypress 2-5703

"We buy from a single item to a complete plant"

FOR SALE EQUIPMENT

FOR SALE: Wilson Mogul Torcair; G.M. powered—96' Lee C. Moore Mast—16" Oil Well Pump—4000'—4½" DP—Located east central Oklahoma—price $50,000.00. Write Box H-821, The Oil and Gas Journal, Tulsa, Oklahoma.

WILSON SUPER—Cleanest small rotary in Oklahoma. New 1953. Stands doubles. New drawworks engine. Nearly new 10" Gaso mud pump. 3000' good 3½" drill pipe. Complete every way. Drills to 3700 feet easily. Bargain $40,000.00. Box H-829, The Oil and Gas Journal, Tulsa, Oklahoma.

AIRCRAFT PARTS & REPAIRS
Mr. Aircraft Owner: Take advantage of our extra special service and vast inventories of Parts, ENGINES, PROPELLERS, TIRES and Supplies. Domestic and Foreign shipments. C A A approved repair station No. 3846.
VESTCO
Dept. L, Box 5366 T A
Denver 17, Colo.

GASOLINE PLANT *FOR SALE*

Gasoline Plant, located in **Brazoria** County, Texas, shut down in **January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Detailed inventory available upon request.**

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ATTENTION OIL INDUSTRY
(Operators, Producers and Drillers)
FOR SALE
$100,000.00 Inventory Drilling Tools
At 35% OFF
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REED CORE KINGS
Cutter Heads and Core Catchers
Sizes from 5⅞" to 8⅛" both Hard and Soft formations for K-500 to K-675 barrels, complete with K-36A 2 piece Core Catcher.

REED CUTTERS
(For Wire Line Coring)
Sizes from 7⅞" to 9⅞", both Hard and Soft formations, both Pin and Box connections for all type barrels.

H. C. SMITH, SECURITY AND REED ROLLER ROCK BITS
Sizes from 5⅞" to 9⅞". Soft, Medium and Hard formations. Includes some Jet Bits.
All materials guaranteed factory new, manufactured 1952. No leasing agreement required. Write for detailed list and prices.

B. E. Cowan & Associates
Box 328 Elizabethtown, Kentucky

LEASE AND DRILLING BLOCKS

FOUR ALL NEW Linda K Shale Shakers now at Corpus Christi. Will sell at far less than list price. Spare parts are available. Box H-819, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 2—55 M bbl. fabricated shells with structures. 2—55 M bbl. dismantled not fabricated complete less bottoms. Can furnish new bottoms or roofs re-erected. S. Skeen Staley, Jr. 3530 Singleton Blvd., Phone ED-2-6643, Dallas.

BUCYRUS-ERIE Spudder—36 L. Buda engine, butane equipped. Auxiliary leg. Tools from 15½" to 9". Completely equipped and ready to drill. Inventory furnished upon request. Robert J. Orr, 1928 Crestview Dr., Bartlesville, Okla. Phone 5427.

FOR SALE

NEW 3" AND 4" LINE PIPE

23,156'—3½" O.D., 7.62# Lapweld, T&C, 20' SRL.
7,059'—3½" O.D., 7.58# Lapweld, 40' DRL, Ends Beveled.
16,100'—4½" O.D., 10.79# Continuous Weld, 25' to 26' RL, Ends Beveled, Coated and Wrapped.
659'—4½" O.D., 10.79# Lapweld, 40' DRL, Ends Beveled, Coated and Wrapped.

Priced Low—Prompt Shipment—
New Orleans, Louisiana.

MID-STATES PIPE & SUPPLY CO.
Ph. 2-9128 Tulsa, Okla.

SAVE MONEY

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8" LINE PIPE
LAPWELD 8⅝" O.D. 28.55

Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.
Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi.
Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ⅓ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

Brokers and agents protected

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FOR SALE EQUIPMENT

GARDNER-DENVER FXD 7¼"x10" Mud Pump unitized with engine. Skid mounted. General Tool & Supply Co., Box 4387, Oklahoma City, Okla.

COMPLETE NATIONAL 50 Drilling Rig Operating West Texas. Not priced at a sacrifice, but excellent terms available to responsible company or individual. Would consider leasing with option to purchase. Box H-824, The Oil and Gas Journal, Tulsa, Oklahoma.

USED ROTARY EQUIPMENT. Complete rigs, three to ten thousand feet. Used engines, Cats, Murphys, General Motors, Waukeshas, Budas. Slush pumps, draw works (extra fine U-15), hooks, blocks, tables, etc. Write or call Ike Ridenhour, 1758 N. Bluff, Wichita, Kansas. Phone Murray 4-3596.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE OR DEAL

Three rebuilt Type 80 Cooper Gas Engine Driven Compressors. Cylinders to suit. Two as is. Compressor cylinders all sizes.

W. S. SMITH
205 Thompson Bldg., Tulsa, Okla.
Tel. 2-5473.

FOR SALE

1 Caterpillar generator, A.C., 15 K.W.
1 Century generator, D.C., 10 K.W.
1 General Electric generator, D.C., 10 K.W.
1 Westinghouse, D.C., 10 K.W., generator.
1 Kohler electric plant, D.C., 1½ K.W., 4 cylinder.
1 Kohler electric plant, D.C., 5 K.W., 4 cylinder.
1 Kohler electric plant, 5 K.W., Waukesha motor, F.C.-140.
All in excellent condition, may be seen at Makin Yard, Hobbs, New Mexico, or call 3-4062 or 3-3141.

MAKIN DRILLING COMPANY
P. O. BOX 1628
HOBBS, NEW MEXICO

3750 BBL. PER DAY MODERN OIL REFINERY

LOCATED AT POCATELLO, IDAHO

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- **PRODUCTS PRODUCED:** Motor Fuels—Burning Oils—Asphalt.
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- **AUXILIARY EQUIPMENT:** Heat Exchangers—Pumps—Engines—Compressors—Metering & Control Equipment—Piping Boiler Plant—Steel Buildings—(47) Welded Storage Tanks from 300 to 35,000 bbl. capacity.

TO BE SOLD AT A FRACTION OF ITS REPLACEMENT COST

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Machinery & Equipment Merchants

FOR SALE EQUIPMENT

SULLIVAN 200 complete with tools ready to work, located Tulsa, Oklahoma. Contact R. F. Mesker, 1129 E. 15th St., Phone 4-9483.

MODEL S-33 Walker-Neer Spudder Serial #1485. NEW—Never been set up—Sell at discount. Write P. O. Box 127, Lovington, New Mexico. Phones 8533 or 3791.

PIPE SALE
Large quantity of used, standard line pipe for sale. Because material must be moved quickly, will sell at the following bargain prices: 2" @ 5c per foot; 3" @ 11c per foot; 4" @ 14c per foot; 8" @ 45c per foot. If interested, call, write, or wire to The Tri-State Pipe Company, Bellaire, Ohio, Telephone—42.

WILSON MOGUL double drum rig with 145 GKU Waukesha, 87' mast pole, 6' high 30' long substructure, 12" Brewster rotary, tool house, water tank, 5" x 10" slush pump with engine, tongs, slips, generating set, shale shaker, complete with all hand tools. Three (3) years old, $25,000.00. Stored at Odessa. Norvell-Wilder Supply Company, Box 2178, Houston, AT-3471.

FOR SALE—Horizontal Duplex Steam Pumps—10x8½x12—353 GPM—bronze fitted—max. discharge pressure 100 lbs.—6" suction—5" discharge—mfg. by American Marsh Co. Quantity available—NEW—Boston Metals Co. 313 E. Baltimore St., Baltimore 2, Md., Curtis 7-5050.

2—200 H.P. CLARK direct driven compressors less compressor cylinders $2000.00 each. 1 Do with 8½" and 10" compressor cylinders $3250.00 Located near Kilgore, Texas. Nolan Sales Corp. Tulsa, Okla.

CLEAVER-BROOKS Steam Generator Units; 2 (Only) 17,500 lbs./Hr. Each, 100 PSI, Automatic, Gas Fired. Excellent. Refinery Materials Company, Box 14306, Houston.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply, Tulsa.

Gas Compressors

2—Worthington DC-2 Gas Compressors, sizes 15 x 7¾ x 12—13 x 7¾ x 12, 457 CFM—250# Discharge—Complete with motors, starters, spare parts.

Brazos Engineering Company, Inc.
Box 9114 Houston, Texas FA 8367

RECONDITIONED BLACK PIPE

8⅝" O.D. .322 Wall 28.55 pound in 16' to 20' Random Lengths. Approximately 8,500 Feet.
12¾" O.D. .375 Wall 49.56 pound in 16' to 20' Random Lengths. Approximately 12,500 Feet
IMMEDIATE SHIPMENT
Subject to Prior Sale
Write—Wire—or Phone

BROWN-STRAUSS Corporation

1546 Guinotte Kansas City, Mo.
Phone HA 1000

EQUIPMENT WANTED

WANTED: One—Cooper-Bessemer GMX-4 Compressor, with high pressure cylinders. Box H-841, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

PETROLEUM ENGINEER OR GEOLOGIST

with broad general knowledge of the petroleum industry in East Texas, North Louisiana and South Arkansas to fill position with well established firm in area. State qualifications in detail.

Box H-785, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

GENERAL MANAGER for integrated oil company in South America. Prefer geological or petroleum engineering background with college degree and experience. Must also be a capable administrator and supervisor. Salary commensurate with experience and qualifications. Send detailed personal history and work experience to Box H-795, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER

Independent Oklahoma refinery desires young, ambitious engineer acquainted with control and process trouble shooting and development. State experience and development. State experience fully and minimum starting salary. Replies confidential. Box H-840, The Oil and Gas Journal, Tulsa, Oklahoma.

DESIGN ENGINEERS

Well established, progressive company expanding its Houston, Texas manufacturing facilities requires additional design engineers. Experience in design and development of oil well drilling tools and equipment would be favored. This is not just another job. If you have ability and can think, opportunity exists. Send complete information and salary requirements. Confidential.

BOX H-836,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

WANTED—Experienced Seismic Party Chiefs, Seismologists and Chief Computers. Must have college degree. Excellent opportunity for advancement. Replies will be held in confidence. Box H-844, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Graduate electrical, civil or mechanical engineer for office and field work by major oil company in Middle West. Please state age, experience and educational qualifications. Box H-837, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVE ENGINEER: Degree in Petroleum Engineering or Geology. Location—St. Louis, Missouri. State age, salary, references and general qualifications. Box H-827, The Oil and Gas Journal, Tulsa, Oklahoma.

MANUFACTURERS REPRESENTATIVE
Reciprocating Pumps

Duties: Cover water flood, gasoline plants and general industrial sales, Oklahoma, Kansas, Arkansas.

Qualifications: Small active organization. Familiar oilfield operations and services.

Give full resume, sales coverage, personnel and present line. Replies will be held confidential.

BOX H-838,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

OIL INDUSTRY Employment Service. Tom Robinson, owner, 405 Tuloma Bldg., Tulsa, Oklahoma. Specializing in Engineers with oil-industry experience.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

FIELD SUPERINTENDENT: We have an opening for a Kansas district requiring supervision of 1000 bbl. daily production. Promising future. State age & qualifications. Strictly confidential. Write Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

IMMEDIATE OPENING for graduate engineer desiring sales work. Home office location, Tulsa, Oklahoma. Give complete resume of experience, references, and salary expected in first reply. Box H-803, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE AND CONSTRUCTION SUPERVISOR

for expanding independent refinery in Upper Midwest. 5 or more years refinery or process plant experience required. Challenging opportunity for qualified man. Write giving full particulars.

Box H-831, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEERS

Openings for Chemical Engineering Graduates with minimum 3 years experience in Process Plant Design. Work involves project engineering, equipment application and selection, translation of process data into new plant design. Applicant should be well grounded in thermodynamics, unit operations, and equipment specifications. The work is interesting, salary and opportunities are attractive; location in Texas. Mail resume to

Box H-820,
The Oil and Gas Journal,
Tulsa, Oklahoma.

GEOLOGIST

Independent oil company has opening June 1 in Tulsa office for qualified sub-surface geologist. Must be familiar with Mid-Continent Area, particularly Oklahoma, and be capable of handling geological operations at divisional level. Age limit 40. Excellent position for right party. Give complete past employment record and educational background. All replies confidential.

Box H-804,
The Oil and Gas Journal,
Tulsa, Oklahoma.

MANAGERIAL PERSONNEL NEEDED

For Research Centre in The Petroleum Industry

Ente Nazionale Idrocarburi (E.N.I.) has under its supervision a number of Italian Companies active in the field of petroleum and petrochemicals. ENI's major activity is centered in the following items:

- gas and oil field exploration and exploitation (current production: 105 billion cu. ft. of natural gas per year);
- operator of a 2500-mi. pipe-line system (capacity over 700 million cu. ft. per day);
- owner and operator of a tanker fleet of around 120,000 dwt;
- owner and operator of an extensive network for distribution of petroleum products and LP-gas throughout Italy (64 Bulk plants, 4000 stations, etc.);
- control over or shareholding in refineries having a processing capacity of about 6 million tons of crude oil per year;
- owner of factories (1500 employees) for construction of machinery;
- shareholding of chemical plants (700 employees) for production of synthetic dyes, detergents, etc.;
- under construction, a petrochemical plant (production capacity—30,000 tons per year of synthetic rubber and 350,000 tons per year of ammonium nitrate).

E.N.I. is organizing a big research center for investigation and development of petroleum processing and manufacture of petrochemicals. Some departments are expected to begin operation next summer.

Italian or foreign technical experts, with a wide educational background, specific training, organizational and managerial ability, are required to fill positions as heads of the main departments of the laboratories.

Specifically the following are sought:

1) Chemist or physicist with specific knowledge and experience in thermodynamic and chemico-physical problems;
2) Chemist specialized in the preparation of organic compounds particularly those derived from hydrocarbons;
3) Inorganic chemist soundly and completely acquainted with modern methods of experimentation, research and testing;
4) Engineer or industrial chemist specially trained in the methods for improving petroleum products applications;
5) Engineer or physicist, with physico-technical and technological training, specialized in the problems of thermo-technics, measurements and controls;
6) Engineer or industrial chemist with extensive research experience in the field of crude oils processing;
7) Engineer or industrial chemist particularly experienced in extending laboratory procedures to pilot plants;
8) Engineer with good theoretical knowledge and laboratory experience in engine tests on fuels and lubricating oils;
9) Engineer or industrial chemist specially trained both in theory and practice in the fields of corrosion and protective means for materials.

Note: University degree mandatory.

Applications should state age and other usual personal data, educational background and qualifications, practical experience, etc. and should include a photograph. Please address personally to the: **Presidente dell'Ente Nazionale Idrocarburi, Via Lombardia, 43 - Roma - Italy,** with the special note **RISERVATA PERSONALE** (i.e., to be opened by addressee only).

Absolute discretion in every respect is assured.

Salary offered will be in accordance with position, training and qualities required.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

HELP WANTED

HELP WANTED

THE STANDARD OIL COMPANY (OHIO)

Manufacturing (Refining) Department

is looking for

CHEMICAL ENGINEERS, CHEMISTS, and MECHANICAL ENGINEERS

with one to five years experience in petroleum refining or related activities for staff work primarily in Cleveland, Ohio. Possible employment in Toledo, Lima, or Cincinnati, also.

Applicant should have the following educational background and industrial experience:

CHEMICAL ENGINEERS: B.S. or higher degree and experience in development, pilot plant operation, process design, process trouble shooting, refinery process engineering, economic studies, or related work background.

CHEMISTS: B.S. or higher degree and experience in product and process research or development.

MECHANICAL ENGINEERS: B.S. or M.S. degree and experience in process equipment construction, design, inspection, or maintenance, petroleum product testing and field evaluation, or related work background.

Age Range 22 - 32

Salaries commensurate with experience and level in organization. Advance on merit basis.

If you can qualify and are looking for a permanent job with a growing but secure midwest company, write, giving full information on education, industrial experience, military experience, and personal data to

E. G. GLASS, JR.

1737 Midland Building, Cleveland 15, Ohio.

SITUATIONS WANTED

EXPERIENCED WATERFLOOD Engineer. Seven years diversified. Major and Independent companies; Texas, Louisiana, Mississippi, Arkansas, Kansas, Oklahoma. Extensive secondary recovery, primary drilling, producing, reservoir, lease evaluation, unitization. Employed. Wants more responsible position. Box H-658, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, age 31, Oklahoma University graduate. Now on terminal leave from position of Production Superintendent in South America desires to locate in Southwest. Eight years experience field production. Box H-842, The Oil and Gas Journal, Tulsa, Oklahoma.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY

P. O. Box 1628, Hobbs, New Mexico
Phone 3-3141.

146 Allen Building, Midland, Texas.
Phone 2-2962.

SITUATIONS WANTED

REFINERY Operations Supervisor, over 13 years refinery experience, 8 years foreman, cat cracker, etc. Box H-818, The Oil and Gas Journal, Tulsa, Oklahoma.

CORROSION and communications engineer. Ten years experience pipeline business. Desires employment. Box H-835, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-GEOPHYSICIST, 30, married, 6 years experience Rocky Mountain. (5 in seismic and gravity, 1 subsurface logs.) Desires position with active independent or major. Box H-845, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST, desires position with independent in Mid-Continent area. Four years well sitting experience, West Texas, New Mexico and Rocky Mtn. area. Stratigraphic studies, acreage evaluation experience, recoverable reserve studies, subsurface mapping, electrical log interpretation. Box H-839, The Oil and Gas Journal, Tulsa, Oklahoma.

INSTRUMENT Engineer-Technician, 3½ years supervisor-engineer, 7 years technician, desires supervisory position in refinery-chemical industry. Equivalent 2 years college. Box H-843, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER, 30, family, 8 years thorough exceptionally, diversified process control engineering and supervision at two of world's largest refineries. Currently in South America. Will locate responsible organization desirable area USA or elsewhere if unusual challenging situation. Box H-813, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GRADUATE Petroleum Engineer with sixteen years experience in engineering, drilling and production for major and independent operators desires connection with active independent. Box H-806, The Oil and Gas Journal, Tulsa, Oklahoma.

SUBSURFACE GEOLOGIST, single, 29, 4½ years broad experience, now with Major in South, desires position in Denver area. Box H-812, The Oil and Gas Journal, Tulsa, Oklahoma.

DISTRICT GEOLOGIST desires position with independent operator or company on interest basis. Thoroughly qualified in all phases exploration, drilling, producing and leasing deals. Nine years subsurface experience Central and W. Texas and SE N. Mexico with major and small companies. Age 35. Now located W. Texas. Box H-822, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

PIPELINES ANNOUNCED: Projected pipelines indicate increasing action in central Williston Basin, where we specialize in royalties in major company blocks. For informative material, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Mont.

JACK EAGLE, Oil Properties, 706 City Nat'l. Bldg., Oklahoma City, Oklahoma, Telephone REgent 6-7027.

OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

OIL PRODUCTION ROYALTIES

Interested in buying oil production and producing royalties in good producing areas. Minimum monthly income on producing properties $4000, on royalties $750.

CONTACT BOX 2775, DALLAS, TEXAS

LEASE AND DRILLING BLOCKS

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Investments.

TULSA INDEPENDENT wants lease or drilling deal. Illinois area, with good geology. Box H-832, The Oil and Gas Journal, Tulsa, Oklahoma.

LOCATION KANSAS—200 acre lease, 4 producing wells, 3—100 bbl. tanks, equipment new, will drill two additional wells, all for $17,500. Box 114, Erie, Kansas.

FOR SALE: Working interests in twelve producing oil wells in Russell and Ellis Counties, Kansas. W. G. Hills, Mankato, Kansas.

LEASES ROYALTIES

Producing and Nonproducing
Bought and Sold—Any Area

Inquiries Invited

B. D. BUCKLEY

6835 Delmar Ave., St. Louis, Mo.

WANTED

WANT TO BUY settled oil production by independent operator direct from the producer. No deals too small or too large. P. O. Box 77, Lafayette, La. Dudley J. LeBlanc.

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Producing oil properties and producing royalties, any amount. Mail engineer's report with last 6 months oil runs.
Inspection made immediately.
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LEGAL

Sealed bids will be received until 1:00 P. M., Monday, June 20, 1955, and opened at that time at the Shawnee Indian Sub-Agency for the leasing of allotted Indian lands located in Pottawatomie, Cleveland, Lincoln, and Payne Counties, Oklahoma, for oil and gas mining purposes. For additional information write or telephone Mr. Robert D. Grover, Area Field Representative, Shawnee, Oklahoma. (Telephone No. 318)

LEGAL

Sealed bids will be received until 2:00 P.M., Central Standard Time, June 21, 1955, and opened at that time in the office of the Superintendent of the Turtle Mountain Consolidated Indian Agency, Belcourt, North Dakota, for the leasing of 2,258.75 acres of Tribal land and 7,995.88 acres of allotted Indian land, located in Township 162 North, Range 71 West, 5th Principal Meridian, Rolette County, North Dakota, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Superintendent of the Turtle Mountain Consolidated Agency, Belcourt, North Dakota, or by a call to telephone No. 6742, Rolla, North Dakota.

"Personally I thought I detected a rather pronounced Mid-Continent oil tang."

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Sour Zone Discovery For Osceola, Mich.

Reacidized in the Detroit River "sour zone" with 5,000 gal., after an initial treatment with 1,500 gal., the C. W. Jetter 1 Bregg N½ NW SW 5-17n-10w, Richmond Township, Osceola County, was completed good for 156 bbl. of 50.4°-gravity crude oil, flowing by heads, as the first producer to be completed in this zone to date. Reed City pool previously produced oil from the Roger City and Reed City Dundee zones, the Traverse and the Richfield. A Michigan Stray sand gas field, now being used for gas storage purposes also overlies the bulk of the field.

The Jetter 1 Bregg was drilled out dry in the Richfield at 4,618 ft. and was then plugged back to 4,383 ft. and completed in the shallower "sour zone." Well is on the extreme south flank of the pool.

Two new Reed City zone oil producers were being tested and completed in the Reynolds pool, Reynolds Township, Montcalm County. Both wells were drilled by the discoverers of this field, McClure Oil Co., Swan-King Oil Co., Basin Oil Co. and George Ackerman.

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Four 8′ x 5′ National Rapid Mechanical Water Filters in West Texas.

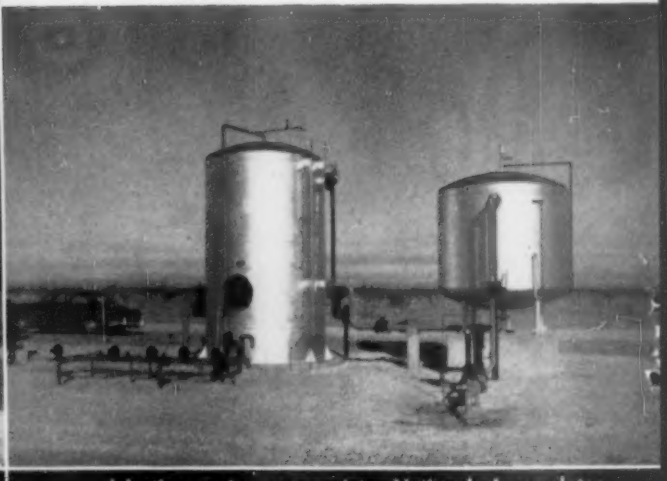
Four 10′ x 5′ National Rapid Mechanical Water Filters on an Oklahoma water flood project.

National Rapid Mechanical Water Filters are used for filtering water in salt water disposal and water flood projects and municipality installations. Filters are rated according to best empirical values. Common backwash rates are 12 to 20 gallons per minute, per sq. ft. of filter area.

Size	Nominal Water Cap. Bbl./Day	Approxmiate Weight of 40 lb. W.P.
4′ x 5′	1060	1400 lb.
6′ x 5′	2300	2100 lb.
7′ x 5′	3200	2400 lb.
8′ x 5′	4200	3200 lb.
10′ x 5′	6600	5540 lb.

NOTE: Filters are furnished in 40, 75 and 100 PSI W.P.

A National 4′ x 5′ Rapid Mechanical Water Filter in a water disposal plant in Texas.



Injection water passes into National Accumulator from National Rapid Mechanical Water Filter.

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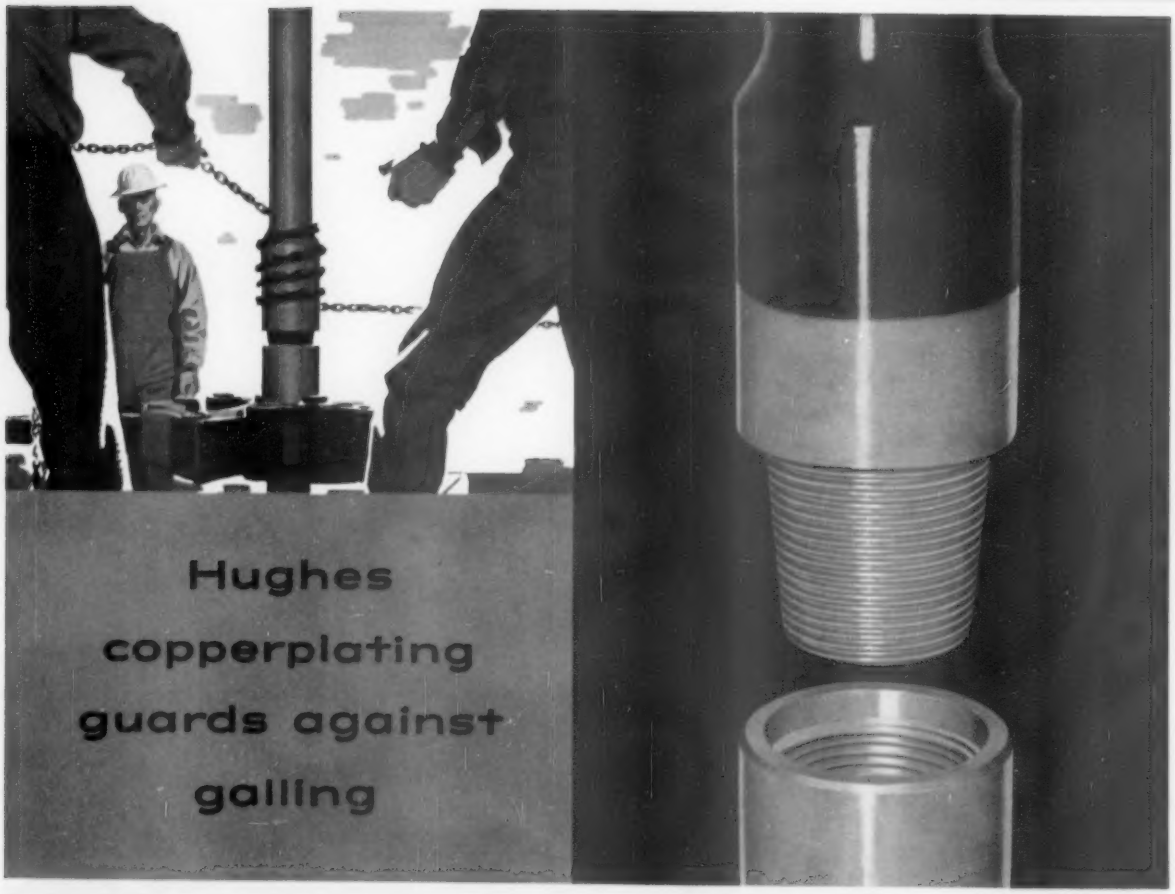

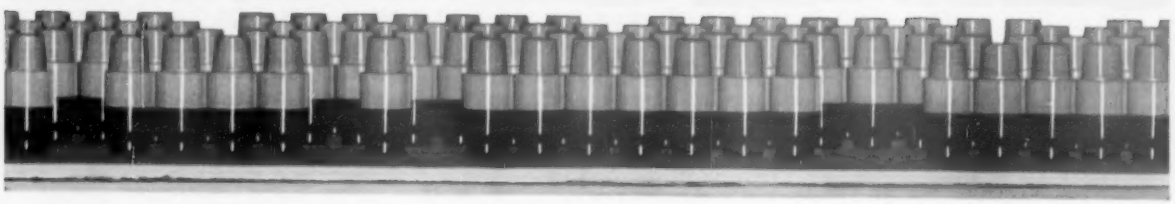

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